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Abstract

This thesis is a collection of five independent but closely related studies. The overall purpose is to approach the analysis of learning outcomes from a perspective that combines three major elements, namely lifelong-lifewide learning, human capital, and the benefits of learning. The approach is based on an interdisciplinary perspective of the human capital paradigm. It considers the multiple learning contexts that are responsible for the development of embodied potential – including formal, non-formal and informal learning – and the multiple outcomes – including knowledge, skills, economic, social and others– that result from learning. The studies also seek to examine the extent and relative influence of learning in different contexts on the formation of embodied potential and how in turn that affects economic and social well being. The first study combines the three major elements, lifelong-lifewide learning, human capital, and the benefits of learning into one common conceptual framework. This study forms a common basis for the four empirical studies that follow. All four empirical studies use data from the International Adult Literacy Survey (IALS) to investigate the relationships among the major elements of the conceptual framework presented in the first study.

Study I. A conceptual framework for the analysis of learning outcomes

This study brings together some key concepts and theories that are relevant for the analysis of learning outcomes. Many of the concepts and theories have emerged from varied disciplines including economics, educational psychology, cognitive science and sociology, to name only a few. Accordingly, some of the research questions inherent in the framework relate to different disciplinary perspectives. The primary purpose is to create a common basis for formulating and testing hypotheses as well as to interpret the findings in the empirical studies that follow. In particular, the framework facilitates the process of theorizing and hypothesizing on the relationships and processes concerning lifelong learning as well as their antecedents and consequences.

Study II. Determinants of literacy proficiency: A lifelong-lifewide learning perspective

This study investigates lifelong and lifewide processes of skill formation. In particular, it seeks to estimate the substitutability and complementarity effects of learning in multiple settings over the lifespan on literacy skill formation. This is done by investigating the predictive capacity of major determinants of literacy proficiency that are associated with a variety of learning contexts including school, home, work, community and leisure. An identical structural model based on previous research is fitted to the IALS data for 18 countries. The results show that even after accounting for all factors, education remains the most important predictor of literacy proficiency. In all countries, however, the total effect of education is significantly mediated through further learning occurring at work, at home and in the community. Therefore, the job and other literacy related factors complement education in predicting literacy proficiency. This result points to a virtual cycle of lifelong learning, particularly to how educational attainment influences other learning behaviours throughout life. In addition, results show that home background as measured by parents' education is also a strong predictor of literacy proficiency, but in many countries this occurs only if a favourable home background is complemented with some post-secondary education.

Study III. The effect of literacy proficiency on earnings: An aggregated occupational approach using the Canadian IALS data

This study uses data from the Canadian Adult Literacy Survey to estimate the earnings return to literacy skills. The approach adapts a labour segmented view of the labour market by aggregating occupations into seven types, enabling the estimation of the variable impact of literacy proficiency on earnings, both within and between different types of occupations. This is done using Hierarchical Linear Modeling (HLM). The method used to construct the aggregated occupational classification is based on analysis that considers the role of cognitive and other skills in relation to the nature of occupational tasks. Substantial premiums are found to be associated with some occupational types even after adjusting for within occupational differences in individual characteristics such as schooling, literacy proficiency, labour force experience and gender. Average years of schooling and average levels of literacy proficiency at the between level account for over two-thirds of the premiums. Within occupations, there are significant returns to schooling but they vary depending on the type of occupations. In contrast, the within occupational return of literacy proficiency is not necessarily significant. The latter depends on the type of occupation.

Study IV: Determinants of economic and social outcomes from a lifewide learning perspective in Canada

In this study the relationship between learning in different contexts, which span the lifewide learning dimension, and individual earnings on the one hand and community participation on the other are examined in separate but comparable models. Data from the Canadian Adult Literacy Survey are used to estimate structural models, which correspond closely to the common conceptual framework outlined in Study I. The findings suggest that the relationship between formal education and economic and social outcomes is complex with confounding effects. The results indicate that learning occurring in different contexts and for different reasons leads to different kinds of benefits. The latter finding suggests a potential trade-off between realizing economic and social benefits through learning that are taken for either job-related or personal-interest related reasons.

Study V: The effects of learning on economic and social well being: A comparative analysis

Using the same structural model as in Study IV, hypotheses are comparatively examined using the International Adult Literacy Survey data for Canada, Denmark, the Netherlands, Norway, the United Kingdom, and the United States. The main finding from Study IV is confirmed for an additional five countries, namely that the effect of initial schooling on well being is more complex than a direct one and it is significantly mediated by subsequent learning. Additionally, findings suggest that people who devote more time to learning for job-related reasons than learning for personal-interest related reasons experience higher levels of economic well being. Moreover, devoting too much time to learning for personal-interest related reasons has a negative effect on earnings except in Denmark. But the more time people devote to learning for personal-interest related reasons tends to contribute to higher levels of social well being. These results again suggest a trade-off in learning for different reasons and in different contexts.

Descriptors: lifelong learning, lifewide learning, human capital, literacy skills, International Adult Literacy Survey, benefits of learning, learning outcomes

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Richard Desjardins
Stockholm, December 2003

Introduction

1. Introduction to the studies

1.1 Human capital theory

By the 1960s, the theory of human capital was formalized and rapidly became a field of inquiry. The theory suggests that the embodied potential of individuals has a profound impact on standards of living via its productivity effect. This proposition brought the idea that people are the most valuable asset of a nation to the forefront of economics. Most of the concepts involved such as capital and productivity, are indeed economics concepts, and therefore, it is of no surprise that this field of inquiry was introduced by and continues to be firmly grounded in the economics discipline.

The theory, however, has far reaching implications, which extend beyond the disciplinary boundaries that have manifested themselves over the last century. For example, the formation of human capital extends into education, psychology, sociology, and linguistics, to name only a few. Even the very nature of what embodied potential means is deeply rooted in many other disciplines including psychology, biology, philosophy and sociology. Finally, the impact of embodied potential on standards of living is much more complex than the neo-classical economic treatment of the theory, and involves psychology, sociology and political science.

While the theory has been influential, there is a growing concern and dissatisfaction with its treatment. First, not all potential sources of human capital investment are considered in empirical applications. By omitting economically relevant learning activities, most empirical applications do not maximize the informational value of the human capital theory framework and thus leave many questions unanswered.

Some suggest that embodied potential is becoming increasingly important for the production structures and hence standards of living of some countries (e.g., Brown, 2001). Accordingly, it is important to understand better the processes of human capital formation. In particular, a better understanding of the contributing influence of different learning activities, which span the 'lifelong-lifewide' dimensions of learning is desirable. For example, even though informal learning appears to be pervasive in advanced societies (Livingstone, 2000), little is known about its relative contribution to the creation of human capital (Solow, 2000). In general, further research is needed to gain a

greater understanding of the substitutability and complementarity of learning occurring in different settings and over the lifespan.

Second, neo-classical interpretations have shortcomings that unnecessarily limit the scope and relevance of the human capital framework. Only considering the embodied potential that is deemed to be directly relevant to productivity is too simplistic. Economic systems are interdependent with other systems; learning, for example, that contributes to the development of the social and political systems will indirectly influence economic systems (see McMahon, 1999). In this sense, the economic relevance of different types of learning may be broader than previously suggested; and learning that would otherwise be deemed consumption might have more of an investment dimension than previously thought. Little is known about which learning or which types of embodied potential lead to different impacts, and how the different impacts of learning are interrelated.

Finally, the vindication that economic well being is the only end reflecting higher standards of living is easily refuted. There is little doubt that embodied potential has a positive impact on standards of living [other than increased productivity in the production of goods and services exchanged on markets]. Therefore, embodied potential that leads to social and human development but not necessarily economic development, also represents stored value that should be considered an asset. Extending the theory of human capital to encompass a broader notion of well being is not incompatible with the economics discipline, and especially not with welfare theory.

1.2 Interdisciplinary and continuous thinking in the social sciences

Historians and philosophers have for a long time shown an interest in how knowledge is created and how it is passed on within and across generations. But only recently have scholars from many different social science disciplines joined them in the study of these processes (Keeves, 1997). This has brought many new methods and new perspectives to this area of inquiry. Moreover, these processes are inherently intertwined with the wider social and behavioural sciences. This presents an extraordinary challenge for educational and social science researchers.

In general, scientific inquiry has assembled an immense body of knowledge about social and psychological processes including educational processes. But it is apparent that few major generalizations have emerged that can be directly applied to benefit the creation and transmission of knowledge or the operation of society (Keeves, 1997). Keeves (1997) points out, however, that it is naive and simplistic to expect that the body of knowledge relevant to the social and

behavioural sciences can be used to improve educational, social and psychological processes in the same way that the body of knowledge relevant to the natural sciences is used to improve the physical world.

As a major reason for this difference, Keeves suggests that individuals create their own knowledge and ideas through a process of assimilating and accommodating the debate surrounding the body of knowledge into their own frame of mind. This changes their views and perceptions of the social and behavioural “real-world”. In turn, through social action, which is the process by which individuals or groups affect social and behavioural processes, changes in educational and other social processes are perpetuated. The perpetuation increases the perceptions and understanding of those processes, and through scientific inquiry adds to the body of knowledge relevant to the social and behavioural sciences. It is evident that in the human and behavioural sciences, researchers play an important role in the nature of social action by advancing generalizations, which are manifested through the educational and social theories held by them.

The body of knowledge, however, is so vast that educators have a task of making simple and coherent the extensive and complex ideas and relationships from this body of knowledge. This is necessary to communicate what is known in such a way as to permit the assimilation and structuring of these ideas and relationships in the minds of individuals. But the vastness is so great that specialization has become necessary.

While the body of knowledge relevant to educational, social and psychological processes is vast and continues to grow, it still needs to be further assimilated into a coherent and meaningful body. This is the task of researchers. But educators who tend to be specialized according to disciplines can inadvertently limit the scope of this task, and researchers are further limited by their own need to specialize. This perpetuates a deeply fragmented body of knowledge, which has negative consequences for social action. Accordingly, it is important that generalizations that are suggested by research attempt to draw from as broad a body of knowledge as possible. Moreover, the need to train educators and researchers in areas that transcend disciplinary boundaries is evident, as is the need to sustain a democratized approach to developing and transferring the body of knowledge.

A recent study of citations in the social sciences by Pieters and Baumgartner (2002) illustrates the extent of fragmentation occurring between the economics discipline and the wider social sciences. Their findings suggest that while many academics, who specialize in management, finance, accounting, marketing, political science and sociology, not to mention policy makers, rely heavily on

the economics discipline, research in the economics discipline rarely builds on knowledge from closely related disciplines.

Concern about the negative consequences of research based on fragmented bodies of knowledge is highlighted by the recognition of interdisciplinary research approaches in recent years, which have grown dramatically. Not surprisingly, interdisciplinary research perspectives are currently part of every fashionable research policy agenda. Considering the mounting evidence of the potential impact of learning on human existence, adapting an interdisciplinary approach to analysing learning outcomes, in terms of their formation across the lifespan and in multiple settings and their impact on individuals and societies, is tantamount.

A separate but related issue involves the interpretation and use of concepts and theories in the social sciences. While the purpose of theories is to systematize a set of ideas and relationships, they never provide a complete picture. Consequently, several alternative and opposing theories, each with limited usefulness, are often involved in the debate surrounding the body of knowledge as well as the methods of scientific inquiry that add to the body of knowledge. In some cases the theories may overlap and in others they be mutually exclusive.

For the sake of clarity, however, it is common to view concepts and theories discretely even though there is overlap. A drawback to this approach is the inadvertent promotion of discrete or absolute thinking, which invariably leads to narrow interpretations of phenomena and their concomitant properties. Table 1 lists some basic theories and concepts that are relevant to this thesis and susceptible to discrete application. While this approach is both necessary and useful, synchronous and continuous thinking are also necessary to achieve balanced perspectives of concepts and theories in the social sciences. The latter is key to reconciling scientific theories with “real-world” observations.

Table 1. Dichotomous/discrete thinking in scientific research

Economic development	Social development
Human capital theory	Screening theory
Investment	Consumption
Literate	Illiterate
Emic	Etic
Cultural practices paradigm	Individual skills paradigm
Formal learning	Informal learning
Quantitative research methods	Qualitative research methods

2. Overall purpose and specific objectives of the studies

The overall purpose of this collection of studies is to approach the analysis of learning outcomes from a broad conceptual framework that combines three major elements, namely lifelong-lifewide learning, human capital, and the benefits of learning. The approach is based on an interdisciplinary perspective of the human capital paradigm. The framework presented considers the multiple learning contexts that are responsible for the development of embodied potential – including formal, non-formal and informal learning – and the multiple outcomes – including knowledge, skills, economic, social and others– that result from learning. The studies also seek to examine the extent and relative influence of learning in different contexts on the formation of embodied potential and how in turn that affects economic and social well being.

Five independent studies relating to this overall purpose are presented as a collection of studies. See the next section for a discussion of how the studies relate to each other. The following lists the primary objective(s) of each study:

Study I. A conceptual framework for the analysis of learning outcomes

1. To develop a conceptual framework relating some key concepts and theories that are relevant for the analysis of learning outcomes.
2. To provide a basis for formulating and testing hypotheses as well as to interpret the findings in further empirical studies. In particular, to facilitate the process of theorizing and hypothesizing on the relationships and processes concerning lifelong learning as well as their antecedents and consequences.

Study II. Determinants of literacy proficiency: A lifelong-lifewide learning perspective

3. To investigate the lifelong and lifewide processes of skill formation. In particular, to estimate the substitutability and complementarity effects of learning in multiple settings over the lifespan on literacy skill formation.

Study III. The effect of literacy proficiency on earnings: An aggregated occupational approach using the Canadian IALS data

4. To gain a better understanding about the role of the work setting in the skill formation process. In particular, to investigate the role of literacy skills in relation to the nature of occupational tasks.

5. To estimate the economic return to literacy skills from an aggregated occupational approach. Specifically, to acknowledge heterogeneity in labour markets and allow the effect of literacy proficiency on earnings to vary according to its relevance in different occupational types.

Study IV: Determinants of economic and social outcomes from a lifewide learning perspective in Canada

6. To estimate the relative impact of learning in different contexts and for different reasons on different outcomes.
7. To gain insight into the consequences of learning in different contexts and for different reasons.

Study V: The effects of learning on economic and social well-being: A comparative analysis

8. To add an international comparative perspective to Study IV.

3. Relationship of the studies

Five independent, but closely related studies on lifelong-lifewide learning, human capital, and the benefits of learning, are presented in this thesis. The first study combines these three major elements into one common conceptual framework. The thread linking the three major elements is based on the notion that learning leads to well being, hence the title of the thesis. The framework brings together many theories and concepts that have emerged from varied disciplines including economics, educational psychology, cognitive science and sociology, to name only a few. Accordingly, some of the research questions inherent in the framework relate to different disciplinary perspectives.

Four applied studies follow the conceptual framework outlined in the first study. All four of these studies use data from the International Adult Literacy Survey to investigate the relationships among the major elements of the framework.

The second study, *Determinants of literacy proficiency: A lifelong-lifewide learning perspective*, investigates the relationships between lifelong-lifewide learning and the formation of human capital. Specifically, it focuses on the effects of learning across the lifespan and in multiple settings on the formation of literacy skills. The approach follows from educational and literacy research and incorporates an international comparative perspective.

Shifting to the relationship between human capital and the benefits of learning, the third study, *The effect of literacy proficiency on earnings: An aggregated occupational approach using the Canadian IALS data*, focuses on

the relationships between indicators of human capital and labour market earnings. The approach is firmly grounded in the economics discipline.

The fourth and fifth studies combine all three major elements of the conceptual framework into one operationalized structural model. Specifically, the fourth study, *Determinants of economic and social outcomes from a lifewide learning perspective in Canada*, explores the variable impact of learning in different contexts and for different reasons on different types of outcomes, namely earnings and community participation. The fifth study, *The effects of learning on economic and social well-being: A comparative analysis*, extends the fourth study by adding an international comparative perspective. These latter two studies have an interdisciplinary perspective.

4. Significance of the studies

The first study is significant by offering a broad conceptual framework from which further interdisciplinary studies can approach the analysis of learning outcomes. Interdisciplinary approaches to analyzing the outcomes of learning avoid the risk of focusing on only one line of research. As an example, narrow economic approaches that overlook peripheral and structural feedback effects will invariably lead to misguided policies. The human capital framework has thus far proven to be valuable because it offers a powerful means to inform and support education policy. But it is hoped that a broader perspective of the theory will help to generate better policy relevant information.

The applied studies are significant by contributing to scientific knowledge about the relative effects of learning in different settings over the lifespan on the development of skills as well as on certain social and economic outcomes. They also provide insights into the variable impact of learning in different contexts and for different reasons.

Economies and societies are increasingly dependent on knowledge and information, making a holistic approach to the analysis of learning outcomes all the more important. Individuals are facing ever-increasing demands that require them to devote time and other resources to learning, not just for work but also to balance other personal and social demands. Accordingly, this research attempts to contribute to a better understanding of lifelong learning processes both in terms of their effect on skill development and their impact on social and economic outcomes.

Recent policy efforts associated with the implementation of lifelong learning underscore the growing importance of incorporating lifelong learning theories and concepts into applied research as it is done in this thesis. Three of the applied studies consider multiple learning contexts, which span the lifelong-lifewide learning dimensions, simultaneously. This is necessary to generate

findings that will help to integrate and build strong links between formal, non-formal and informal learning over the lifespan, and hence for lifelong learning systems to evolve.

5. Limitations of the studies

Approaching the analysis of learning outcomes from an interdisciplinary perspective is itself a limitation since the body of knowledge surrounding the topic is so vast. The approach in this thesis builds on an economic perspective of the human capital theory.

Data used in the applied studies are based on a cross sectional study, namely the International Adult Literacy Survey. Thus, the results represent a picture at one point in time only, and do not provide estimates of direct and indirect effects of various learning activities on economic and social outcomes over one's life cycle. A longitudinal study with all the variables of interest including direct measures of skills for representative populations is not yet available.

Also the data on adult education and training only refers to the twelve months preceding the survey. The analysis would be much more telling and complete with a record of adult education and training over the person's lifetime. In general, while the studies incorporate indicators that span the lifewide dimension of learning, there are many relevant learning activities that are not considered because the data are not available.

Another important limitation is the availability of measures of learning outcomes. The studies use the direct measure of literacy skills made available through the International Adult Literacy Survey. While the measure is deemed to a good indicator of general skills, it omits other important skills such as communication and interpersonal skills, not to mention other learning outcomes such as affective behaviours.

Many other missing variables limit the studies. For example, no empirical evidence on the hypothesized causal link between knowledge and skills and productivity is offered because only the earnings data is available. Ability is another variable that is not factored into the following research.

6. Main conclusions of the studies

Findings from the collection of studies included in this thesis provide support for the following propositions:

- While learning in school has the strongest impact on the development of general human capital, learning informally at work, at home, in the community and in leisure maintains a substantial impact
- Together, learning informally at work, at home, in the community and in leisure can have a larger impact on the development of general human capital than schooling
- Informal learning at work has a substantial impact on economic outcomes such as earnings
- Informal learning at home and in leisure has a substantial impact on social outcomes such as individual involvement and participation in the community
- Informal learning can substitute or compensate for low levels of schooling and home backgrounds that feature relatively low educative climates
- A lack of informal learning can lead to loss of human capital acquired during formal schooling and in nurturing home environments during childhood
- The substantial impact of informal learning on the development of human capital, economic and social outcomes warrants the regular production of indicators that allow for the monitoring of informal learning flows
- A large part of the expenses that are related to informal learning has an investment dimension that needs to be acknowledged further

References

- Brown, P. (2001). Skill formation in the 21st century. In Brown, P., A. Green, H. Lauder (Eds.), *High Skills* (pp.1-55). Oxford: Oxford University Press.
- Livingstone, D. (2000). Exploring the icebergs of adult learning: findings of the First Canadian Survey of Informal Learning Practices. NALL Working Paper No. 10-2000. Ontario Institute for Studies in Education, University of Toronto.
- McMahon, W. (1999). *Education and Development: Measuring the Social Benefits*. Oxford: Oxford University Press.
- Keeves, J.P. (1997). Introduction: Towards a unified view of educational research. In Keeves, J.P. (Ed.), *Educational Research, Methodology, and Measurement: An International Handbook, Second Edition* (pp.1-7). Oxford: Pergamon Press.
- Pieters, R. & Baumgartner, H. (2002). Who talks to whom? Intra- and Interdisciplinary Communication of Economic Journals, *Journal of Economic Literature*, 40(2), 483-509.
- Solow, R. (2000). Towards a macroeconomics of the medium run, *Journal of Economic Perspectives*, 14(1), 151-158.

A Conceptual Framework for the Analysis of Learning Outcomes

1. Introduction

This introductory study presents a conceptual framework for the analysis of learning outcomes. The approach is based on a lifelong-lifewide learning perspective and an appreciation for the wider benefits of learning. First, the process of developing embodied potential such as the formation of knowledge and skills is considered; and then in turn, the use of that potential to realize benefits is considered. The framework forms a basis for formulating and testing hypotheses as well as to interpret the findings in the empirical studies included in this thesis.

There are a number of different disciplines that are concerned with these issues, posing a significant interdisciplinary challenge to those interested in studying learning and learning outcomes (Dave, 1976). Coming from an economics perspective, this study uses an already well-established framework as a starting point, namely the human capital framework, which reasonably encompasses the wide-ranging issues of concern in this thesis. The theory of human capital forms a useful framework for considering the embodied potential of human beings, the development of that potential, and the translation of it into benefits.

Given its appeal, however, there is a growing dissatisfaction among social scientists with the way the theory is treated in empirical applications. No doubt this is partly due to data limitations and the difficulty of dealing with many of the issues involved in a rigorous empirical manner. One of the major problems is that not all elements that lead to the development of human potential are considered, nor are they well understood. For example, the total learning effort of individuals is not accounted for in most empirical applications. To do so would be an enormous challenge.

Three reasons for this challenge are stated here. First, the availability of data that reflects the total learning effort is parsimonious. Second, the cost of gathering such data can be prohibitive. Third, it is difficult to measure the total learning effort, partly due to the fact that it is not well suited for measurement,

but also because learning processes are complex and not well understood across disciplines.

Beyond empirical applications, many interpretations of human capital theory do not formally acknowledge or deal with the total learning effort in a satisfactory manner. Perhaps interpretations are merely practical and are limited to the empirical realities of dealing with human capital. Nevertheless, a comprehensive treatment of the theory, which is based on all encompassing view of the total learning effort, is needed to help advance empirical research. A broader approach to empirical applications is desirable and necessary, at least from a systems point of view, in order to gain a better understanding of learning processes.

One way to advance the theory of human capital is to merge it with lifelong learning concepts and theories. Accordingly, this study introduces lifelong learning concepts and theories into the human capital perspective. A more formal treatment of this approach is left for further study, since the purpose here is merely to establish a conceptual framework for the studies included in this thesis.

Another important element that is not satisfactorily acknowledged in many interpretations of human capital theory, are the range of potential benefits that can be realized as a result of human capital. There is little doubt that human potential reflects stored value that will be realized in the future, beyond a mere realization of increased productivity that is associated with the goods and services that are exchanged and hence valued on markets in monetary terms. Therefore, broader notions of social and human development must also be considered as important outcomes of human capital investments. This is a basic responsibility of the economics discipline, whose analysis serves as a primary input into the decision making process of allocating scarce resources to different economic and social activities so as to maximize society's welfare.

The conceptual framework that is presented is seen as a useful basis for guiding the collection and analysis of meaningful information about learning and learning outcomes. Such information is needed to gain a better understanding of the interactive and cumulative effects of learning in multiple settings over the lifespan. Moreover, it is vital to those concerned with the design, implementation, management and overall guidance of educational systems and more broadly lifelong learning systems.

2. Basic elements of the framework

This section describes the basic elements of the approach used to investigate learning outcomes. It is based on a notion that the learning, which goes on in schools, colleges and universities, adult education centres and employer-sponsored training is only a part, albeit an important one, of the total learning effort. To capture the full extent of all learning efforts, learning is viewed as a defining characteristic of all human activity. In addition to this, an effort is made to consider and distinguish various learning outcomes.

2.1 Learning Contexts

Learning can occur in a variety of contexts that are distinguishable. The occurrence can be uniquely characterized by the location, physical and psychological atmosphere, nature of the interaction between the individual and surroundings, etc... There are many ways to classify learning, which can facilitate measurement and analyses. One common and tractable way to classify the various activities that make up an individual's total learning effort arises from lifelong learning concepts. Colletta (1996) discusses three different classes, formal, non-formal and informal learning, which together span the entire spectrum of possible learning that occur at a given time. In the lifelong learning literature, the latter is often referred to as the lifewide learning dimension (see Coombs & Ahmed, 1974; Cropley, 1980; Skolverket, 2000). Figure 1 depicts the three classes of learning where each can equally contribute to learning outcomes.

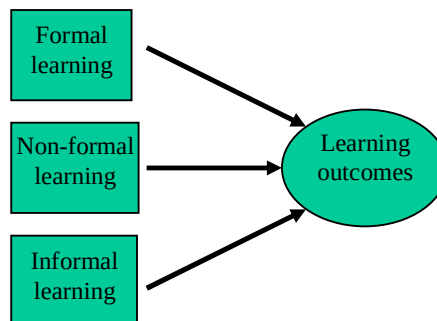


Figure 1. Lifewide learning contexts

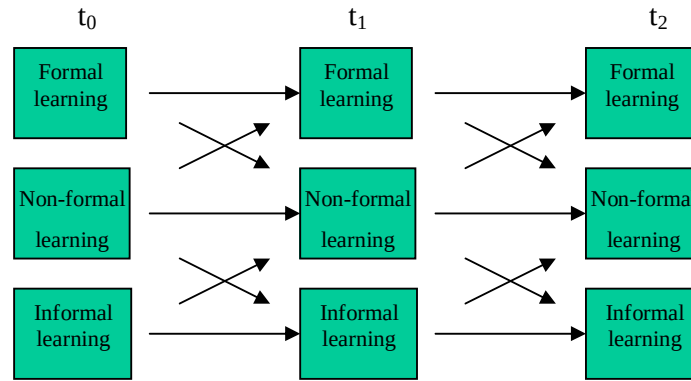


Figure 2. Lifelong-lifewide learning contexts

Source: Tuijnman (2002).

The lifelong learning dimension, on the other hand, spans the entire timeline of an individual from birth to death (Cropley, 1980). For purposes of analyses, it is used to indicate different time periods in which different learning occurs. Together the lifewide and lifelong learning dimensions, as depicted in Figure 2, can be used to analyze the interaction between different learning contexts both within and across time. Given the appropriate measures, the framework depicted in Figure 2 is useful to guide the estimation of the cumulative and interactive effects of various learning over time (Tuijnman, 2002).

2.2 Learning outcomes

The approach also distinguishes between learning outcomes which develop human potential and ultimately how that potential is translated into realized well being. The former refers to learning that develops human capital, either as a conscious effort or as an external by-product of other activities. Human capital is strictly adapted as one's embodied potential to realize future benefits and human capital investments refer to learning consciously undertaken for the purposes of developing that potential. Other learning that contributes to the development of embodied potential but is not consciously undertaken for that purpose is still seen as an important contribution to human capital, albeit arising as a by-product or what is referred to as an externality and not as a direct investment. The definition of human capital that is adapted is consistent with the OECD's most recent interpretation:

“The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well being.” (OECD, 2001, p. 18).

To simplify the discussion, learning outcomes that refer to the development of human capital are called ‘*intermediate*’ learning outcomes. *Intermediate* learning outcomes include knowledge, skills, competences, attitudes, values, beliefs, affective states such as motivation and readiness to learn among others. Historically, such measures for representative adult populations have not been readily available for analysis. There are various reasons for this, but perhaps the most important one arises because such concepts are not easily definable for the purposes of measurement, at least in a meaningful and comparable manner. Not without controversy, advances in the science of psychometric assessments are changing this (Murray, Kirsch & Jenkins, 1998). This is discussed further in the next section.

Learning outcomes referring to the translation of one’s potential (i.e., human capital) into realized well being are for expositional purposes called ‘*final*’ learning outcomes. They can be classified in a variety of ways. As put forth here, investment in one’s potential is not solely for the objective of realizing future economic gains, it is rather for the realization of benefits, which broadly promote and enhance the creation of well being, including economic, social and personal well being. The framework outlined considers economic, social, psychological and physical outcomes. See Schuller, Bynner, Green, Blackwell, Hammond, Preston and Gough (2001) for a similar framework used by the Center for Research on the Wider Benefits of Learning in the United Kingdom.

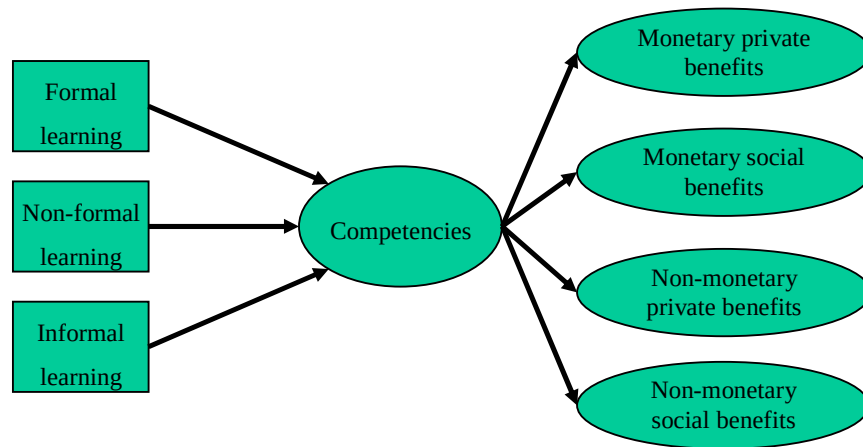


Figure 3. Benefits of learning

It is useful to distinguish final outcomes, assuming they are positive, between individual and collective benefits. Notice that individual economic and social well being are more easily aggregated into macro level measures than psychological and physical well being. For this reason, in combination the latter two are often referred to as personal well being. McMahon (1998) classifies final learning outcomes as monetary private benefits, monetary social benefits, non-monetary private benefits, and non-monetary social benefits. Figure 3 depicts the various benefits that can arise as a result of embodied human potential (e.g., competencies), which is developed and nourished from a variety of different learning contexts.

Figure 4 offers a specific example of what a conceptual framework including all the elements discussed above could look like. In this example, initial formal learning, which is meant to take account of initial schooling, is suggested to not only develop one's potential but also to influence other learning that can occur in concurrence and subsequence to initial schooling. All learning efforts lead to the development of competence, a complex indicator of individual potential, albeit not indicative of all potential but is becoming tractable and measurable with the advancement of psychometrics. Finally, potential as indicated through competence measures, is singled out as an important factor leading to the realization of various well being including economic, social, psychological and physical well being.

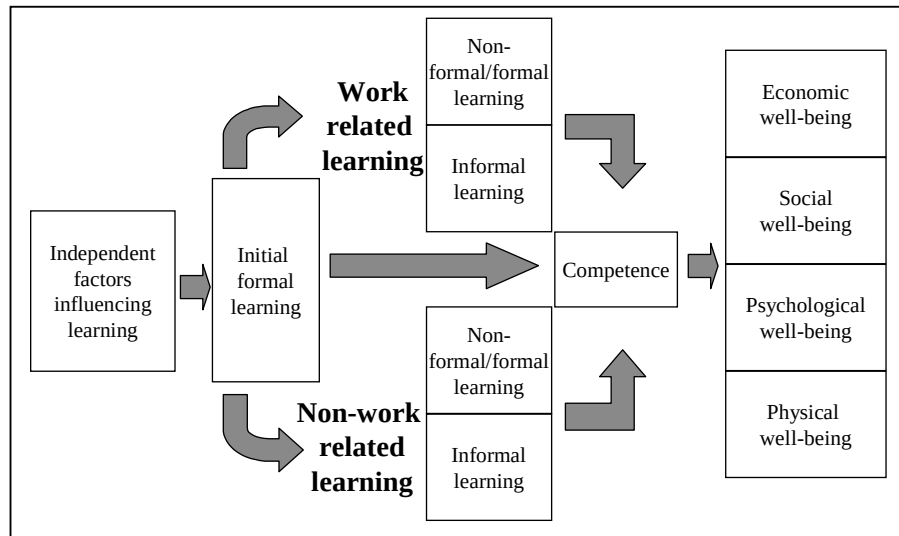


Figure 4. Determinants of learning outcomes from a lifewide learning perspective

Source: Adapted from Desjardins (2003).

3. The measurement of learning outcomes

The primary concern of this study is systems that facilitate learning (called from this point on ‘lifelong learning systems’) and their optimal design given current constraints. This involves the allocation of scarce resources to different systems and the management of those resources within each system so that outcomes associated with learning are optimized. Policy makers, economists, educators and other stakeholders have been concerned with this issue for some time, but especially since the 1960s. For various reasons, there has been a growing awareness of the impact of education on social and economic development as well as a growing demand for education, which together have put additional strain on the resources available to education systems.

A desire to improve the use of available resources is not a new concept in education. As early as the development of national school systems in the nineteenth century, scholars began to study aspects of schooling in other countries with the motive of disseminating such information so as to improve systems in their countries (Postlethwaite, 1998). They were some of the earliest

practitioners of international comparative education. By the 1950s, international organizations such as the United Nations Educational, Scientific and Culutral Organization (UNESCO) and the Organization for Economic Cooperation and Development (OECD) promoted the exchange of information relating to different patterns of educational organization, curricula and teaching methods.

By this time, economists attempted to derive measures of educational 'productivity' in order to inform on the efficiency of different systems. But without objective measures of learning outcomes as reference points, there was no basis for making valid comparisons. Accordingly, there was a need for measures of objective learning outcomes (Anderson, 1961). Using methods of quantitative assessment developed in educational psychology, this led to a series of international comparative studies aimed at measuring the learning outcomes of school-aged children. They were undertaken by the International Association for the Evaluation of Educational Achievement (IEA).

Today, the specification and assessment of learning outcomes has in some countries become an important tool for managing the resources of education systems (e.g., the United Kingdom). But while measures of learning outcomes are undoubtedly valuable, many have warned against the dangers of inappropriately using them (e.g., Hussey & Smith, 2002). For example, they may restrict learning by teaching to the test.

A number of IEA studies since the early 1960s have successfully provided valid, reliable and comparative information on the relative level and distribution of knowledge and skills among school aged children from different educational systems. Numerous studies have used these data to analyze the effectiveness of different schooling contexts.

More recently the Programme for International Student Assessment (PISA) has produced similar data for a number of OECD as well as some non-OECD countries. While PISA collects data for school-aged children, namely 15-year olds, it extends its focus beyond the effect of schooling contexts on learning outcomes, by also considering the effect of learning contexts outside of school such as the home and others. PISA collects data from the lifewide learning perspective introduced in Section 2.1.

This follows from the re-introduction of lifelong learning theories and concepts into policy discourses in the early 1990s. But PISA still only considers accumulated learning up to the age of 15. This omits much of the learning that is believed to go on beyond the age of 15, and is assumed to bare strong significance on the development of human capital, such as learning in higher education, further adult education and training, and learning on the job as well as other informal learning.

A central concept in the lifelong learning ideology is that significant learning occurs beyond national schooling systems. Therefore, to understand better the processes that lead to the development of embodied potential, it is also desirable to obtain measures on learning outcomes and the corresponding learning efforts over the life cycle. This would provide useful information for the design and management of lifelong learning systems.

Accordingly, the International Adult Literacy Survey (IALS) represents an undertaking that has collected data on the learning outcomes of representative adult populations and part of their learning efforts as well as other relevant background information. The IALS has reportedly achieved the successful measurement of literacy skills in a comparable manner and for representative adult populations of 22 countries or regions. This dataset enables the application of the framework discussed herewith, albeit with limitations since it is a cross sectional dataset. The dynamic nature of learning processes cannot be taken into account.

It is clear that further sustained research and development is necessary to continue advancing the science of measuring the learning outcomes of representative adult populations. The IALS only offers measures of functional literacy skills. While literacy skills are important foundation skills that are believed by some to be general and transferable, and are likely to have an important impact on economic and social development, there are also other equally important learning outcomes that should be considered. There is no list of such skills that are agreed upon, however (Murnane, Willet & Levy, 1995). Furthermore, different learning outcomes are likely to have different impacts on economic and social development.

As part of the ongoing research and development, there is a major project entitled *Definition and Selection of Competencies: Theoretical and Conceptual Foundations* (DeSeCo) that was recently completed (Rychen & Salganik, 2001). The project was conducted under the auspices of the OECD and led by the Swiss Federal Statistical Office in collaboration with the United States Department of Education and the National Centre for Education Statistics. The project explored the conceptualization of different learning outcomes that are in this study referred to as ‘*intermediate*’ learning outcomes.

4. Theoretical foundations of the framework

There are a variety of different theories that can be used to formulate hypotheses concerning the relationship between learning contexts and learning outcomes. This section elaborates on select theories that help to define, describe

and support the conceptual approach presented. The theories selected illustrate a variety of different mechanisms that are seen as key to revealing the nature and structure of the relationships investigated. Moreover, the discussion aims to set a basis for the eventual operationalization of the proposed framework and the testing of various hypotheses.

4.1 Resource conversion theory

As a starting point, it is useful to draw an analogy to the resource conversion process put forth by Coleman (1971, 1990), since it captures the essence of the conceptual framework presented. Coleman based his approach on a convention commonly used by economists, namely an *input-output analysis*.

Before proceeding it is important to clarify the meaning of terms as they are intended in the following discussion. *Resources* are defined as things that can be used for support or help, whereas *capital* is defined as an asset that can be used to generate *value* at a future point in time. Note that the term *value* is used here instead of *income*. The latter refers to *money*, which is simply an abstract form of stored value, and a means to facilitate the exchange of stored value on markets. Further, stored value reflects the potential to realize future *benefits*, which promote or enhance *well being*. Finally, *investments* are the acquisition of things that may lead to future benefits.

By interpreting the terms as they are defined, it is evident that resources can be used to create capital, which can generate future value, that in turn can be translated into benefits that promote or enhance well being. Investment is the conscious process of using resources to create capital, but this can also occur without realizing it. And finally, because capital itself is a resource, capital can be invested to create additional capital.

The substance of Coleman's theory of resource conversion follows from this logic. In particular, the theory suggests that resources available at time t_0 can remain the same, grow, or be reduced at time t_1 , depending on how the conversion process plays out with time.

Resources and capital can be classified in a number of different ways. For example, resources can be derived from the family, community, school, work place, society, etc... These can be used to generate financial capital, human capital, social capital, cultural capital, intellectual capital, organizational capital, etc... Coleman (1971) developed the theory as part of his wider theory of using resources for social change. In particular his work focused on the need for disadvantaged groups, such as African Americans in the United States, to use family and community resources that are available as a means to promote their

standing in society. In his work, Coleman has also suggested the importance of the education system in this process of converting resources into capital.

In the same spirit, the framework presented here places learning processes at the heart of resource conversion processes. Learning involves processes whereby individuals invest resources to develop their embodied potential to realize benefits. Whether individuals, especially children do this consciously, however, is another matter. External forces undoubtedly condition most learning processes, especially those of an organized nature such as schooling. Families, communities and society systematically invest resources in order to create processes that facilitate and promote individual learning, but at the same time they also profoundly influence the nature of those processes.

In fact, some have suggested that educational processes are designed to serve as a means for reproducing financial wealth, social status, culture as well as knowledge and skills and other characteristics that serve to enhance the potential for individuals to realize benefits. By extension they can be instrumental for cultural advancement and the general well being of society.

On the other hand, access to quality educational processes can be limited and restricted. Thus it is important to consider opportunities and access to quality processes that facilitate learning. Naturally, opportunities vary according to circumstances, but access also depends on a variety of financial, social, personal and cultural resources. The work of Bourdieu and Passeron (1977), for example, implies that resource conversion is influenced by dominant social groups which seek to preserve their *habitus*.

Social prestige and status, which is gained through achievement or inheritance, can have a significant impact on opportunities and access to various educational processes (see Blau & Duncan, 1967). Furthermore, educational attainment plays a major role in expanding the opportunities and choices of individuals over the lifespan (Blau & Duncan, 1967; Saha, 1994).

The family background influences opportunities and access to learning in many ways. These range from the influence that the home background exerts on individual development including readiness to learn (i.e., affective learning behaviours), and the possibility of obtaining favourable access because of socio-economic status. Beyond this, one's occupational profile and status, alongside social and cultural norms strongly influence one's learning practices and support for continued exposure to enriching learning contexts. Status also influences one's affiliations and access to social groups, which themselves can lead to learning opportunities.

Finally, filtering and selection mechanisms either imposed through social, cultural or natural means are also significant factors affecting opportunities to

learn (Teese, 1994). By extension, institutional factors such as the design of education systems, including selection, grading, and the streaming of children can have a profound impact on opportunities and access to learning.

4.2 Educational production functions

Managing the resources available to schools in order to achieve the best possible combination of learning outcomes is a basic element of educational management. Educators, theorists and experimenters on learning have devoted much thought to this issue. For example, economists and educational psychologists alike have attempted to analyze the relationship between school resources and school performance. Although from different perspectives, their purpose is the same, to determine school effectiveness in producing learning outcomes.

The economic perspective tends to be analogous to an industry production function approach (Levin, 1995). Given a certain technology, which is essentially the generalization of a process, factories will use inputs such as labour and capital to produce goods or services that are valued and exchanged on markets. A general formulation of the educational production function approach used by economists can be found in Hanushek (1986). Essentially, it specifies achievement as a function of family inputs (i.e., parental education, income, race, home language), teacher inputs (i.e., qualifications) and other school inputs (i.e., class size, materials, curriculum).

Drawing a generalization from 187 studies of educational production function studies conducted in the United States, Hanushek (1986) suggests that variables reflecting the institutional structure of expenditures as well as teacher and school quality (i.e., class size, teacher's education, teachers' experience, teachers' salaries, expenditures per pupil, on administration and facilities) are not systematically related to performance. Accordingly, the conclusion is that policies based solely on inputs such as general reductions in class size or uniform increases in expenditures are unlikely to be successful (Hanushek, 1995). On the other hand, there may be evidence to the contrary with respect to teacher education and expenditures on facilities in the developing context.

Partly in response to the Coleman Report (1966), which suggested that schools and teachers are not important to educational performance, many studies have found that indeed teachers and schools unequivocally differ in their effectiveness. But while this is the case, Hanushek (1995) suggests that few studies, which have examined the effect of indicators reflecting school and teacher quality, curricula and instructional methods on achievement, show

consistent results. Hanushek (1995:281) writes that much of the research concerned with educational performance "...fails to capture many of the truly important inputs to the educational process".

Educational psychologists on the other hand, who also conduct studies that seek to explain variations in student learning outcomes, report different results. While maintaining a production function type approach, much research following this tradition tends to include variables that are more relevant to teaching-learning processes, rather than just inputs to the educational processes. By taking account of some of the qualitative aspects of learning environments, many studies report significant effects that are consistent.

The Carroll model of school learning (1963) serves as a landmark study in educational research of this type. There have been many expansions and adaptations to his model that have generated valuable research findings and impacted various aspects of education and teaching. The model is originally based on the learning of foreign languages (Carroll, 1962), but was then generalized to the learning of any cognitive skill or subject matter. It postulates five variables that can account for variations in school achievement: aptitude, opportunity to learn (time allowed for learning), perseverance (motivation), quality of instruction and ability to understand instruction. Correlations and effect sizes for all these variables tend to be significant in the directions that are expected. Only the quality of instruction variable fails to show a consistent significant effect, which may be due to the problems of measuring this variable (Carroll, 1989).

While the model is still a simplification of reality, it has proven useful in explaining complex phenomena. Perhaps this is because it considers a number of variables that reflect learning processes. In particular, the time spent on learning is acknowledged. The model specifies that the degree of learning is a function of the ratio of time spent learning to the time needed to learn. This is further conditioned on aptitude as well as the motivation of students. Still there are problems because while time can be measured, it is difficult to meaningfully measure what goes in the head of students during that time (Carroll, 1989). Perseverance as measured by the amount of time students are willing to spend on learning, however, is an indicator partly controlling for this.

An important implication that arises from this type of research, is that the qualitative use of the resources connected to the learning processes occurring in schools, especially time, is critical to explaining educational productivity. Moreover, it demonstrates the importance of acknowledging that the student actively engages in educational processes to create learning outcomes. This is the fundamental difference that distinguishes the production of human capital

with industrial production. Educational processes can exist, and they can use all the resources they may wish, but there will be no outputs if learners do not engage in these processes.

Walberg's model of educational productivity is essentially an extension of the Carroll model. He includes the social environment of the classroom, the student's home environment, peer influences and the effects of mass media. In his research, Walberg finds nine factors that affect learning outcomes, including affective, behavioural and cognitive learning, which are potent, consistent and generalizable (see Fraser, Walberg, Welch, & Hattie, 1987). The following summarizes the factors that encompass his theory of educational productivity (reproduced from Fraser *et al.*, 1987: 150).

Student aptitude variables

1. Ability or prior achievement, as measured by the usual standardized tests;
2. Development, as indexed by chronological age or stage of maturation;
3. Motivation, or self-concept, as indicated by personality tests or students' willingness to persevere intensively on learning tasks.

Instructional variables

4. Quantity of instruction (amount of time students engage in learning);
5. Quality of instruction, including psychological and curricular aspects.

Educationally stimulating psychological environment

6. Home environment;
7. Classroom or school environment;
8. Peer group environment outside the school;
9. Mass media environment, especially amount of leisure-time television viewing.

Walberg's model goes beyond the schooling context and considers all contexts spanning the lifewide learning dimension. Indeed, Fraser *et al.* (1987) note the powerful influences of out of school factors, especially the home environment. They go on to say that the time spent in school up to the age of 18 is only about 13 per cent of the waking and potentially educative time.

4.3 Formation of human capital beyond schooling contexts

It is clear that learning processes and hence the formation of *intermediate* learning outcomes extend beyond schooling contexts. An important distinction, however, is that schooling involves some of the most highly organized

processes that are explicitly designed to facilitate learning. Moreover, the primary purpose of schooling as well as other organized processes is to produce *intermediate* learning outcomes. Nevertheless, as is evident from educational psychological research, it is the learner who actively converts available resources into learning outcomes; and this can occur in any context.

The extent to which learning processes are conditioned by external forces vis-à-vis the individual's own will is a matter of significant importance. Education is one such force that exerts influence over learning processes. Parents, families, peers, communities, colleagues, employers, the media and more broadly societies and cultures are also forces that condition individual learning processes. Consequently, while learning requires individuals to actively convert resources into learning outcomes, learning processes may not always be the result of one's own conscious will.

A related issue is the extent to which learning outcomes arise as a by-product of engaging in other activities. Learning can arise by engaging in activities whose primary purpose is to produce something other than learning outcomes. This could range from being totally unaware of the learning that is going on to an explicit allowance for learning by doing.

Setting aside, for a moment, the possibility for unconscious learning and learning as a by-product; a number of economists have been concerned with the allocation of scarce resources for learning that is undertaken for conscious reasons and whose purpose is to produce learning outcomes. One of the major inputs into the production of human capital is time – the ultimate resource. Thus the conscious investment of time by individuals in order to produce human capital has received much attention; in particular, by economists who have been concerned with the life cycle of earnings (e.g., Ben-Porath, 1967; Heckman, 1976, Mincer, 1974, 1997; Weiss, 1986). The formalized approach taken by such economists suggests that time spent learning in any context can lead to the production of human capital, including the home, work and other environments; and the production of human capital involves the diversion of resources away from other productive activities.

The availability and use of resources other than time are also important for creating the educative climate of any context. Many resources such as the parents' human capital, for example, are used to form the educative climate of the home. Fraser *et al.* (1987) and Bloom (1964) suggest that the educative climate of the home is critical to the formation of learning outcomes. Moreover, there is evidence of interaction between the home and schooling contexts in affecting the learning outcomes of a child. Using resources to learn in the home environment during adult hood is equally relevant.

Among economists, however, the perception of relevance of learning for economic activity has been a major issue. While this may be practical, it may unnecessarily narrow the view of which learning is relevant. Especially if economic activity is limited to market activity; that is, the exchange of goods and services that are valued on markets. Much of the learning that occurs informally in home, leisure and community contexts is relevant to economic activity that extends beyond market activity. Becker's (1965) theory of allocation of time is illuminating in this regard by pointing out that allocation of scarce resources to produce final satisfactions, which are not valued or exchanged on markets, also represent economic activity. His theory implies that any learning that can lead to higher efficiency in the production of final satisfactions is an investment in human capital. Final satisfactions include personal, social as well as economic benefits.

A particularly important learning context that is directly relevant to productive market activity is the work place. The idea of firms investing resources to produce human capital among their employees is well accepted and has led to a special field of study called the economics of training (see Becker, 1962, 1993; Mincer, 1962, 1974). Using resources to facilitate employee learning is thought to lead to future productivity gains. More recently, the realization that human capital needs to be managed, in terms of storing, disseminating, exchanging and transferring it, has led to a new field of study called knowledge management (see Wiig, 1997). In summary, it is well recognized that learning is critical to the proper functioning and improvement of production processes.

Off-the-job training, on-the-job training and informal learning at work, however, have different implications with regard to the investment and use of resources for learning. The former uses resources for the direct production of learning outcomes. The others involve learning by doing, which involves both the production of goods and services as well as learning outcomes (see Arrow, 1962, Rosen, 1972, Killingsworth, 1982). The idea of learning as a by-product of engaging in other activities and more generally economic activity has recently been recognized by economists as a significant positive externality (e.g., Lucas, 1988; Romer, 1990). Specifically, there are notions that there are 'spillovers' associated with learning and the accumulation of knowledge, which are responsible for faster economic growth. Numerous questions remain regarding how best to organize and use resources so as to properly internalize these spillovers in decision making. This phenomenon also places an emphasis on the importance of considering the total learning effort.

Finally, some sociologists have recently pointed out the important role that social interaction plays in the formation of human capital, such as learning in the community (see Schuller & Field, 1998). This falls under the rubric of social capital theory (e.g., Coleman, 1988, 1990). The main proposition is that exchanges and transfers of knowledge can occur through organized and unorganized communications of two or more people. There are a number of implications that arise from this proposition. For example, the organization and use of resources at the community level as well as how institutions are set up.

4.4 Learning processes

Learning transcends multiple contexts and involves complex processes. But because learning processes are often ignored in favour of educational processes, the interactive and cumulative effects of learning in multiple contexts over time are also ignored. Moreover, educational processes are often conceived as ‘black boxes’, in which the interactions between learners and educational processes are ignored. Many economists and sociologists take it for granted that educational processes lead to learning outcomes, even though it is learners who actively create learning outcomes into their individual being.

Cognitive science research suggests that learning processes are complex, involving the conversion of sensory information, reflection, reasoning and other cognitive interpretive mechanisms (Mayer, 1996) that can occur in any context. Their research also suggests that learning outcomes, learning processes and learning contexts are inextricably linked. For example, learners form knowledge and skills, through learning in multiple contexts, not just a single context such as schooling or job-related training. In general, cognitive scientists and educational psychologists, are interested in ‘*intermediate*’ learning outcomes as an end in themselves and they have researched learning processes extensively.

Economists and sociologists on the other hand often take the processes by which *intermediate* learning outcomes are formed for granted, because they are more interested in the ultimate purpose of learning, i.e., *final* learning outcomes, such as economic and social benefits. Interdisciplinary research that considers learning contexts, learning processes, *intermediate* learning outcomes as well as *final* outcomes in an ensemble is parsimonious. This is surprising considering the mounting evidence about the far-reaching implications that learning can have on human existence.

In order to understand and design better educational processes, it is essential to grasp the interactive and cumulative effects of learning in different contexts, across both time and space. Revealing the linkages between different learning

contexts, providers, and sectors is key. It is important to investigate how learning in different contexts interacts with each other, and the extent to which learning in different contexts contributes to learning outcomes. This includes investigations on transitions and pathways between initial schooling, work, and further learning, as well as the complementarity or substitutability among them. Such information is key to designing, implementing, guiding and managing lifelong learning systems.

It is also important for research to take into account the dynamic nature of learning. Learning processes are not only iterative but also interactive in nature. For example, there is evidence suggesting that knowledge and skills, which are an intermediate outcome of learning, are also a direct input into other subsequent learning (e.g., Chi, Glaser & Rees, 1982; Perkins & Simmons, 1988; Dochy, 1992) and hence act not only as an output of learning processes but also as a primary input. Motivation and other affective learning behaviours, which are outcomes of learning processes, are also important determinants of subsequent learning. Figure 6 illustrates the dynamic nature of these processes.

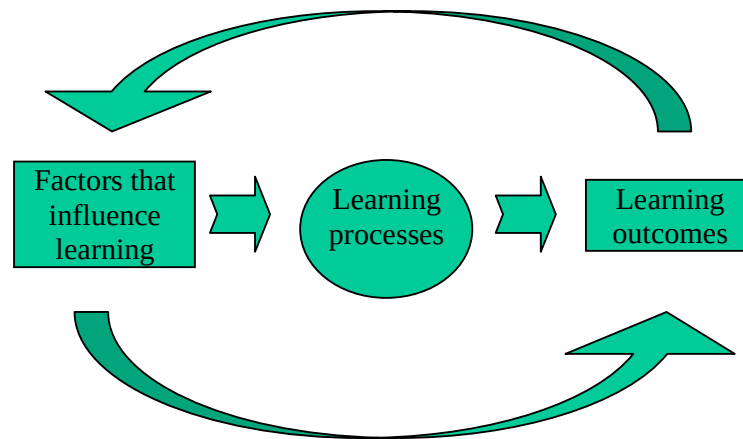


Figure 6. Dynamic effects of learning

4.5 Readiness to learn

Readiness to learn is an important concept in the dynamic flow of learning processes and opportunities. Broadly, it refers to the affective learning behaviours and previous knowledge and skills of individuals. A common

assumption is that it takes human capital to produce more of it. While individuals have initial endowments that are nurtured and developed through a wider resource conversion process, their readiness to learn is seen as key to the development of their embodied potential. Furthermore, findings suggest that those who are more ready are more likely to encounter opportunities. For example, evidence suggests that those with more education or higher skills are also those who obtain favourable access to employer-sponsored training opportunities (e.g., OECD & HRDC, 1997).

The concept is intimately related with learning processes, and in practice it is difficult to separate the two. Nevertheless, it is important to consider the concept separately since it is both necessary for learning and a product of learning. Many theories have emerged, but a universal definition has yet to be decided upon. Kagan's (1992) definition, which is widely accepted, refers to a level of development at which an individual is ready to undertake the learning of specific material.

It is important, however, to distinguish between a child's readiness for school and a more inclusive approach to viewing readiness to learn. The latter considers learning on a recurring basis throughout one's life. Both are important, but they cannot be equated. The former is heavily associated with key developmental transitions that occur in children. It includes physical development such as motor skills, emotional development including an ability to adapt to new experiences, language and communication skills, as well as social and general knowledge. There is growing evidence suggesting that early childhood experiences are powerful predictors of future well being, among other means through the acquisition of literacy, numeracy, problem solving skills, academic performance, and a propensity toward lifelong learning.

From a lifelong learning perspective where learning extends well beyond initial schooling into adulthood and until death, readiness to learn inevitably plays an important role on a recurring basis. The nature and conditions of various learning contexts that arise throughout life interacts with individuals and can profoundly affect their readiness to learn (Bruner, 1960). On a recurring basis, one's readiness to learn also depends on the previous mastery of patterns, concepts and skills, which are prerequisites for more complex processing (Piaget, 1970; Dochy, 1992; Anderson, 1983). One's mental condition and behaviour, which is directed toward learning also affects one's readiness (Kanfer, 1989).

Learner attributes such as motivation, capacity to focus attention, persistence and other factors including individual's feelings, attitudes and emotions are all associated with readiness to learn (Gagne, 1970). Learning styles ranging from

reflective to impulsive are also important in defining one's general behavioural disposition toward learning (Kanfer, 1989). Readiness to learn makes up what is referred to in the cognitive research literature as one's initial state (Shute, 1994).

4.6 Practice engagement theory

Another key theory to consider in the analysis of learning outcomes is practice engagement theory. The main thrust of the theory proposes that engaging in activities on a recurring basis reinforces and develops the individual competencies associated with those activities. Several studies suggest that in environments where adults are exposed to knowledge practices, their cognitive abilities can be maintained and even increased. This has given rise to practice engagement theory, developed by Reder (1994). Conversely, a lack of exposure can potentially lead to a deterioration of ability. This has given rise to the 'use it or lose it' hypothesis (Krahn & Lowe, 1998). In short, those who continuously engage their skills continue to develop their potential, but those who do not risk losing them.

Research indicates that the development of cognitive skills over time depends on a complex interplay between two elements that define intellectual functioning, namely cognitive mechanics and cognitive pragmatism (e.g., Baltes, 1987; Marsiske & Smith, 1998). The first reflects the mechanics of the cognitive system, which includes attentional capacity, processing speed, reasoning, working memory capacity and spatial ability (Marsiske & Smith, 1998). The second refers to the continued deepening of knowledge, which occurs through experience and practice over time including acculturation, education and training (Marsiske & Smith, 1998).

Both elements dynamically interact to determine the net gain or loss that is realised throughout one's process of development (Baltes, 1993; Marsiske & Smith, 1998). Some research indicates that there are noticeable declines that occur in cognitive mechanics as people age (Smith & Marsiske, 1997). In contrast, it appears that cognitive pragmatism tends to increase but at a diminishing rate until an advanced age (Horn & Hofer, 1992; Schaie, 1994; Marsiske & Smith, 1998).

Moreover, it has been suggested that training, for both younger and older adults, can lead to increased plasticity. Despite this more effort may be needed for older adults to learn the same amount of knowledge and skills as younger adults (Marsiske & Smith, 1998). What is important is that the persistent application of knowledge may compensate for a loss of cognitive mechanics (Baltes, 1993; Marsiske & Smith, 1998). Another factor cited as influencing

pragmatism is the role of the context, where studies suggest that knowledge may be preserved in the domains where it is used and applied (Brown, Collins, & Duguid, 1989).

5. Overview of the conceptual framework

Some of the theories discussed above provide support for an advanced causal structure involving the relationship between learning contexts, learning processes, and learning outcomes. The conceptual framework is summarized in Table 1. There are three major elements presented in the table – learning contexts, learning processes, and learning outcomes. There is an implicit causal sequence that can be read from left to right. Individual contexts such as background, culture, and other descriptors of one's general situation are thought to influence and contribute toward defining the learning contexts, which individuals have the opportunity to experience.

Immediate learning environments, such as the classroom or any other situation in which learning takes place, are referred to as learning contexts. These include the location, method, and other relevant descriptors of the particular environment that plays a role in initiating learning processes, either by exposing new information or by prompting reflection. They interact with an individual's initial state, which consists of one's prior knowledge and skill structure, ability (working memory and processing speed), affective state (attitudes, readiness to learn, motivation) (Shute, 1994), as well as one's learning strategies and styles (Pask, 1976). Both the learning context and the initial state combine to affect various learning processes that lead to certain *intermediate* and *final* outcomes (Shute, 1994).

Table 1. Learning contexts, processes and outcomes

Resources		Sensory Information			Initial Learning State	Learning/ Experiential Processes ‘Black Box’ Interactions	Intermediate Learning Outcomes	Decision Making/Choices		Final Learning Outcomes	
Individual Contexts	Learning Contexts										
Gender	Formal learning				Readiness to Learn	Mental conversion of information	Knowledge & Skills			Psychological Well being	Economic Well being
Age	- Curriculum - School factors				- Motivation - Effort, Energy, Involvement, attention allocated	Reflection	Attitudes, Values & Beliefs			States of mind	Financial support
Home-Background	Physical environment					Reasoning	Readiness to Learn			Self-esteem	- Productivity - Wealth
Health	Staffing					Interpretative Mechanisms				Self-respect	
Language	Teaching strategy				Previous K&S					Happiness	
Ethnicity	Non-formal learning				Learning style/strategy					Identity	
Culture	Informal learning									Decision making	
Occupation	Self-directed learning									Physical Well being	Social Well being
Status	Other human and physical interactions									- Health - Nutrition - Safety	- Relations - Friendships - Empathy - Civic Involvement - Democratic empowerment - Law and Order

The vertical columns *Resources*, *Sensory Information* and *Decision Making/Choices* are inserted to assist with the interpretation of the table. Individuals use all the available *Resources* at their disposal to generate learning outcomes. Thus, in addition to being outcomes of conversion processes, resources are also primary inputs, which indicates the fundamentally dynamic nature of these processes. Furthermore, assuming that learning processes are at the centre of conversion processes, these resources are used to define learning contexts, which ultimately define the nature of the *Information* fed into learning processes. Initially, the learning outcomes are *intermediate*, whereby individuals have to in turn *Make Decisions/Choices* on how to use these *intermediate* resources to realize *final* outcomes.

The table should not be interpreted as suggesting that relationships among variables are static. The relationships are often reciprocal, and over time, the variables are dynamically determined, as these processes continuously reiterate themselves. Given current statistical realities, the former poses estimation feasibility problems and given a lack of appropriate data, the latter is difficult to take into account in operationalized frameworks.

References

- Anderson, C.A. (1961). Methodology of comparative education, *International Review of Education*, 7(1), 1-23.
- Anderson, J.R. (1983). *The Architecture of Cognition*. Cambridge, Massachusetts: Harvard University Press.
- Arrow, K. (1962). The economic implications of learning by doing, *Review of Economic Studies*, 29(3), 155-173.
- Baltes, P.B. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline, *Developmental Psychology*, 23, 611-626.
- Baltes, P.B. (1993). The ageing mind: Potential and limits, *Gerontologist*, 33, 580-594.
- Becker, G.S. (1962). Investment in human capital: A theoretical analysis, *Journal of Political Economy*, 70(5), 9-49.
- Becker, G.S. (1965). A theory of the allocation of time, *Economic Journal*, 75(299), 493-517.
- Becker, G.S. (1993). *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education, Third Edition*. Chicago: University of Chicago Press.
- Ben-Porath, Y. (1967). The production of human capital and the life cycle of earnings, *Journal of Political Economy*, 75(4), 352-365.
- Blau, P., & Duncan, O.D. (1967). *The American Occupational Structure*. New York: Wiley.
- Bloom, B.S. (1964). *Stability and Change in Human Characteristics*. New York: Wiley.
- Bourdieu, P., & Passeron, J-C. (1977). *Reproduction in Education, Society and Culture*. Translated by R. Nice. Beverly Hills, CA: Sage.
- Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning, *Educational Researcher*, 32-42.
- Bruner, J. (1960). *The Process of Education*. Cambridge, Massachusetts: Harvard University Press.
- Carroll, J.B. (1962). The prediction of success in intensive foreign language training. In R. Glaser (Ed.), *Training Research and Education* (pp.87-136). Pittsburgh: University of Pittsburgh Press.
- Carroll, J.B. (1963). A model of school learning, *Teachers College Record*, 64, 723-733.
- Carroll, J.B. (1989). The Carroll model: A 25-year retrospective and prospective view, *Educational Researcher*, 26-31.
- Chi, M.T.H., Glaser, R., & Rees, E. (1982). Expertise in problem solving. In R. Sternberg (Ed.), *Advances in the Psychology of Human Intelligence, Volume 1*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Coleman, J.S. (1971). *Resources for Social Change: Race in the United States*. New York: Wiley.

- Coleman, J.S. (1988). Social capital in the creation of human capital, *American Journal of Sociology*, 94, S95-S120.
- Coleman, J.S. (1990). *Foundations of Social Theory*. Cambridge: First Harvard University Press.
- Colletta, N.J. (1996). Formal, nonformal, and informal education. In A.C. Tuijnman (Ed.), *International Encyclopaedia of Adult Education and Training, Second Edition* (pp. 22-27). Oxford: Pergamon Press.
- Coombs, P.A., & Ahmed, M. (1974). *Attacking Rural Poverty: How Nonformal Education Can Help*. Baltimore: John Hopkins University.
- Cropley, A.J. (1980). *Towards a System of Lifelong Education*. Oxford: Pergamon Press.
- Dave, R.H. (Ed.) (1976). *Foundations of Lifelong Education*. Oxford: Pergamon Press.
- Desjardins, R. (2003). Determinants of economic and social outcomes from a lifewide learning perspective in Canada, *Education Economics*, 11(1), 11-38.
- Dochy, F.J.R.C. (1992). *Assessment of Prior Knowledge as a Determinant of Future Learning*. Utrecht: Lemma.
- Fraser, B.J., Walberg, H.J. Welch, W.W., & Hattie, J.A. (1987). Syntheses of educational productivity research, *International Journal of Educational Research*, 11, 145-252.
- Gagne, R.M. (1970). *The Conditions of Learning, Second Edition*. New York: Holt, Rinehart & Winston.
- Hanushek, E.A. (1986). The economics of schooling: Production and efficiency in public schools, *Journal of Economic Literature*, 24(3), 1141-1177.
- Hanushek, E.A. (1995). Education production functions. In M. Carnoy (Ed.), *International Encyclopaedia of Economics of Education, Second Edition* (pp. 277-282). Oxford: Pergamon Press.
- Heckman, J.J. (1976). A life-cycle model of earnings, learning and consumption, *Journal of Political Economy*, 84(4), S11-S44.
- Horn, J.L., & Hofer, S.M. (1992). Major abilities and development in the adult period. In R.J. Sternberg & C.A. Berg (Eds.), *Intellectual Development* (pp. 44-49). New York: Cambridge University Press.
- Hussey, T., & Smith, P. (2002). The trouble with learning outcomes, *Active Learning in Higher Education*, 3(3), 220-233.
- Kagan, S.L. (1992). Readiness past, present, and future: Shaping the agenda, *Young Children*, 48(1), 48-53.
- Kanfer, R. (1989). Conative processes, dispositions, and behaviour: Connecting the dots within and across paradigms. In R. Kanfer, P.L. Ackerman & R. Cudeck (Eds.) *Abilities, Motivation and Methodology: The Minnesota Symposium on Learning and Individual Differences*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Killingsworth, M.R. (1982). Learning by doing and investment in training: A synthesis of two rival models of the life cycle, *Review of Economic Studies*, 49(2), 263-271.
- Krahn, H., & Lowe, G.S. (1998). *International Adult Literacy Survey: Literacy Utilization in Canadian Workplaces*. Ottawa: Statistics Canada and Human Resources Development Canada.

- Levin, H.M. (1995). Raising educational productivity. In M. Carnoy (Ed.), *International Encyclopaedia of Economics of Education, Second Edition* (pp. 283-290). Oxford: Pergamon Press.
- Lucas, R.E. (1988) On the mechanics of economic development, *Journal of Monetary Economics*, 22(1), 3-42.
- Marsiske, M., & Smith, J. (1998). Development of competence: Toward a taxonomy. In T. Husén & T.N. Postlethwaite (Eds.), *International Encyclopaedia of Education* (electronic edition). Oxford: Pergamon Press.
- Mayer, R. (1996). Learners as information processors: Legacies and limitations of educational psychology's second metaphor, *Educational Psychologist*, 31(3/4), 151-162.
- Mincer, J. (1962). On the job training: Costs, returns and some implications, *Journal of Political Economy*, 70(2), 50-79.
- Mincer, J. (1974). *Schooling, Experience and Earnings*. New York: Columbia University Press.
- Mincer, J. (1997). The production of human capital and the life cycle of earnings: Variations on a theme, *Journal of Labor Economics*, 15(1), S26-S47.
- McMahon, W. (1998). Conceptual framework for the analysis of the social benefits of lifelong learning, *Education Economics*, 6(3), 309-346.
- 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.
- Murray, T.S., Kirsch, I.S., & Jenkins, L.B. (Eds.) (1998). *Adult Literacy in OECD Countries: Technical Report on the First International Adult Literacy Survey*. Washington, DC: National Centre for Education Statistics.
- OECD (2001). *The Well being of Nations: The Role of Human and Social Capital*. Paris: Organisation for Economic Co-operation and Development.
- OECD & HRDC (1997). *Literacy Skills for the Knowledge Society: Further Results from the International Adult Literacy Survey*. Paris & Ottawa: Authors.
- Pask, G. (1976). Learning styles and strategies, *British Journal of Educational Psychology*, 46, 4-11.
- Piaget, J. (1970). *Science of Education and the Psychology of the Child*. New York: Orion Press.
- Perkins, D.N., & Simmons, R. (1988). Patterns of misunderstanding: An integrative model for science, math and programming, *Review of Educational Research*, 58, 303-326.
- Postlethwaite, T.N. (1998). Educational achievement: Comparative studies. In T. Husen & T.N. Postlethwaite (Eds.), *International Encyclopaedia of Education* (electronic edition). Oxford: Pergamon Press.
- Reder, S. (1994). Practice-engagement theory: A sociocultural approach to literacy across languages and cultures. In B. Ferdman, R. Weber, & A. Ramirez (Eds.), *Literacy Across Languages and Cultures* (pp. 33-74). Albany, NY: State University of New York Press.
- Romer, P. (1990) Endogenous technological change, *Journal of Political Economy*, 98(5), S71-S102.

- Rosen, S. (1972). Learning by experience as joint production, *Quarterly Journal of Economics*, 86(3), 366-382.
- Rychen, D.S., & Salganik, L.H. (Eds.) (2001). *Defining and Selecting Key Competencies*. Bern: Hogrefe & Huber.
- Saha, L.J. (1994). Sociology of Education: Overview. In T. Husén & T.N. Postlethwaite (Eds.), *International Encyclopaedia of Education, Second Edition* (electronic edition). Oxford: Pergamon Press.
- Schuller, T., & Field, J. (1998). Social capital, human capital and the learning society, *International Journal of Lifelong Education*, 17(4), 226-235.
- Schuller, T., Bynner, J., Green, A., Blackwell, L., Hammond, C., Preston, J., & Gough, M. (2001). *Modelling and Measuring the Wider Benefits of Learning*. London: Centre for Research on the Wider Benefits of Learning.
- Schaie, K.W. (1994). The course of adult intellectual development, *American Psychologist*, 49, 304-313.
- Shute, V.J. (1994). Learning processes and learning outcomes. In T. Husén & T.N. Postlethwaite (Eds.), *International Encyclopaedia of Education, Second Edition* (electronic edition). Oxford: Pergamon Press.
- Skolverket (2000). *Lifelong Learning and Lifewide Learning*. Stockholm: Skolverket.
- Smith, J., & Marsiske, M. (1997). Abilities and competencies in adulthood: Lifespan perspectives on workplace skills. In A.C. Tuijnman, I.S. Kirsch & D.A. Wagner (Eds.), *Adult Basic Skills: Innovations in Measurement and Policy Analysis* (pp. 73-114). Cresskill, NJ: Hampton Press.
- Teese, R. (1994). Reproduction theory. In T. Husén & T.N. Postlethwaite (Eds.), *International Encyclopaedia of Education, Second Edition* (electronic edition). Oxford: Pergamon Press.
- Tuijnman, A.C. (2002). Measuring Lifelong Learning for the New Economy. Paper presented at the *Lifelong Learning and the Building of Human and Social Capital Conference*, University of Nottingham, September 2002.
- Weiss, Y. (1986). The determination of life cycle earnings: A survey. In O. Ashenfelter, & R. Layard (Eds.), *Handbook of Labor Economics, Volume I* (pp.603-640). Amsterdam: Elsevier Science.
- Wiig, K.M (1997). Knowledge management: Where did it come from and where will it go? *Expert Systems with Applications*, 13(1), 1-14.

Determinants of literacy proficiency: A lifelong-lifewide learning perspective

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Abstract

The aim of this article is to investigate the predictive capacity of major determinants of literacy proficiency that are associated with a variety of contexts including school, home, work, community and leisure. An identical structural model based on previous research is fitted to data for 18 countries. The results show that even after accounting for all factors education remains the most important predictor of literacy proficiency. In all countries, however, the total effect of education is significantly mediated through further learning occurring at work, at home and in the community. Therefore, the job and other literacy related factors complement education in predicting literacy proficiency. This result points to a virtual cycle of lifelong learning, particularly to how educational attainment influences other learning behaviours throughout life. In addition, results show that home background as measured by parents' education is also a strong predictor of literacy proficiency, but in many countries this occurs only if a favourable home background is complemented with some post-secondary education.

Keywords: literacy proficiency, literacy determinants, lifelong learning, practice engagement theory

1. Introduction

A number of studies have attempted to identify major factors influencing the acquisition, development and maintenance of literacy proficiency. Presumably, the interest arises from the assumption that literacy is crucial to communication and facilitates personal, social, and economic development. The outcomes of literacy are thought to be pervasive, involving potential benefits such as health, personal and intellectual effects, as well as economic success. Literacy is also assumed to be important for cultural advancement, the preservation of democratic institutions and the general well being of society. Accordingly, social scientists need to better understand what fosters literacy and the nature of its role in society.

Against this background, the aim of this article is to estimate the relative weight of factors modelled to explain observed literacy proficiency. A structural model specified on the basis of theory and previous research is fitted to data representing the populations aged 25 to 65 years in 18 of the countries¹ participating in the International Adult Literacy Survey (IALS, 1994-1998). The IALS has data on direct measures of literacy proficiency along with a comprehensive set of background information conducive to international comparative investigation.

The data analysis has two objectives. First, it seeks to establish whether an apriori structure hypothesized on the basis of previous research can reasonably fit the observed data of 18 countries. In other words, the generality of the underlying causal structure of adult literacy proficiency is considered in order to observe whether similar processes are operating in different countries. Second, the influence of different factors in explaining literacy proficiency is assessed using a comparative method. Thus, this is a study comparing relationships as understood from previous research, rather than a descriptive or developmental study attempting to improve the general understanding of the way in which certain phenomena function (Keeves & Adams, 1997). Although this study develops certain explanations, further studies of a more descriptive nature are needed to complement the findings.

The following provides a brief outline of the article. First, the role of context in developing literacy skills is discussed. Then the relationship between education and literacy is discussed. Third, the lifelong and the lifewide learning perspective in relation to formal education and further literacy development are

¹ Germany, Portugal and Sweden are excluded from the analysis since some of the variables critical to the analyses were not collected for these countries.

elaborated. The subsequent section discusses the determinants of literacy in relation to theory and previous research. Numerous relationships are then hypothesized to form a structural model. Sixth, a brief description of the analytical method is provided, and the results of the Linear Structural Relations (LISREL) analysis are presented from an international comparative perspective. Finally, there is a short discussion on observed patterns and some implications of the findings.

2. The development of literacy: A “Unified Perspective”

Many suggest that literacy involves skills that are learned and developed in particular contexts. While this may be true, few can reject that the literacy skills embodied in individuals facilitate learning and hence the acquisition of knowledge in other contexts. Therefore, the role of the context in relation to skill formation and skill use is an important issue.

‘New Literacy Studies’ emphasize that literacy is bounded by the context in which it is used (Crowther, Hamilton & Tett, 2001), giving rise to a plural view of literacy. While this may partly be true, ‘literacies’ or certain features of literacy learned in one context may also be transferred or applicable in other contexts. That is, literacy may have elements of both specificity and generality with regard to the context in which it is learned or applied. For example, spelling-sound systems of a written language or word recognition skills might be applicable in numerous contexts, while written styles and other uses and conventions of literacy may be applicable to fewer. In general, the transferability of learning and cognition from one context to another is a subject of substantial debate and investigation among scholars (Haskell, 2001).

The development of literacy in a particular context may also contribute to a general know-how (i.e., literacy skills), which deals with the use of literacy in various situations, events or practices, perhaps, both within and across cultures. Reder (1994) describes two distinct research paradigms of literacy, which tend to focus on either the specificity or the generality of literacy, namely the cultural practices paradigm and the individual skills paradigm. The former emphasizes that literacy skills and knowledge are learned within specific contexts of practice, which can vary across languages and cultures, whereas the latter views literacy as a set of de-contextualized information processing skills that are contextualized by the individual when engaging in a variety of specific literacy related situations (Reder, 1994: 40).

In this article, both paradigms are adapted into an alternative view, which is referred to as a “Unified Perspective”. Rather than viewing literacy as progressing from decontextualized to contextualized as in the individual skills

paradigm outlined by Reder (1994), the reverse is considered. As in the cultural practices paradigm, an emphasis is placed on the acquisition of literacy through a variety of specific contexts, such as the home, schooling, work, community and leisure contexts. But following the individual skills paradigm, it is further assumed that there are core literacy [or foundation] skills, which include basic literacy skills as well as an ability to apply these skills in different contexts, so that an individual may possess some apriori know-how regarding the handling of literacy related situations. This view is consistent with both research paradigms of literacy.

The position taken implies that individuals make use of existing general and specific literacy related know-how to handle various literacy related situations. To the extent that previous know-how contributes to the ability of an individual to successfully handle a literacy situation, it may be said that transfer has occurred. One may argue that the extent of transfer in a particular situation reflects general know-how. But while the transfer may occur successfully in one situation it may not in another. Therefore, the extent of transfer may not be constant from situation to situation. A successful transfer can depend on both an accumulation of general and specific literacy related know-how. Finally, engaging in literacy situations throughout the lifespan may lead to the accumulation of both general and specific know-how.

These views present a difficult challenge for any attempt to pinpoint the know-how [or literacy skills] needed to engage in various literacy related situations. Indeed, defining and measuring literacy skills are issues of much debate among scholars (Venezky, 1997; Hautecoeur, 2000). In order to effectively measure literacy skills, literacy must be defined. According to the cultural practices paradigm, literacy can only be defined in terms of specific literacy related situations. Following this view, it may be possible to identify typical literacy related situations, which a group or population is expected to encounter, so that literacy related know-how may be assessed in a comparable way. Designing and administering measurement instruments that reflect these typical literacy related situations, may produce a relevant and reliable assessment of certain literacy related know-how among the individuals of a group or population.

Whether the know-how needed to successfully carry out those literacy tasks is general or specific, it is expected that individuals are able to perform these tasks for the benefit of themselves and the group or population to which they belong. If well designed, the sample of literacy tasks administered may represent a wider expectation of the typical literacy related know-how needed to function in one's group or society (Beaton, 1997), and thus produce a powerful assessment of literacy skills. But these expectations are not neutral and are thus

an issue of controversy. Furthermore, some scholars are concerned in general with the scientific validity and reliability of such measurement instruments as well as this approach to defining and assessing literacy [skills].

Nevertheless, the importance of literacy has led to significant efforts aimed at developing reliable and relevant assessments of literacy skills. In so doing, these efforts have attempted to identify some of the expected literacy related know-how of a population, namely by observing the literacy situations they are expected or likely to encounter. For example, starting with the definition of literacy, UNESCO (1978) moves beyond the concept of basic literacy and writes that a person is 'functionally literate' when he or she is able to "...engage in all those activities in which literacy is required for effective functioning in his group and community and also for enabling him to continue to use reading, writing and calculation for his own and the community's development". This definition attempts to capture the literacy related know-how of individuals in relation to the expectations of their group, community or society.

Gray (1956) originally defined and used functional literacy in an international survey of reading conducted under the auspices of UNESCO in 1956. He defined it as follows:

"A person is functionally literate when he has acquired the knowledge and skills in reading and writing which enable him to engage effectively in all those activities in which literacy is normally assumed in his culture or group." (Gray, 1956: 24).

He explicitly refers to a know-how that is needed to be functionally literate. This know-how refers to a set of more complex literacy skills that adults need rather than just the basic literacy skills learned at a younger age in school.

The measures of literacy proficiency made available by the IALS survey, and analysed in this article, claim that they assess the know-how needed to be functionally literate. Moreover, the study claims to assess functionality at varying levels of complexity. The know-how that is assessed may be viewed as the literacy skills individuals are expected to have to function at different levels of complexity within the society in which they live. In particular, the IALS defined literacy in terms of a mode of adult behaviour, as follows:

"Using printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential." (Murray, Kirsch & Jenkins, 1998: 17).

Furthermore, to make the results comparable, an attempt was made by the IALS team to design instruments that were as invariant as possible in terms of

the expected literacy related know-how across the adult populations to be assessed. Such instruments involved the reading of instructions on a medicine bottle, balancing a cheque-book and other similar literacy related situations that are assumed to be typical and expected to be carried out in order to cope – albeit at different levels – regardless of cultural or social particularities.

Defining and assessing literacy is thought to be important for monitoring the skill distribution of populations and producing information that is useful for decision-making and the formulation of policy that helps to sustain and develop literacy. But for the latter it is important to know how literacy related know-how is sustained and developed over time and across different contexts. Accordingly, literacy assessments such as the IALS also collect contextual and background information to help interpret the results.

Theory suggests that performance on typical literacy related tasks is influenced by a number of factors not least the engagement or practice in literacy related situations. The latter is thought to contribute to both specific and general literacy related know-how in both an interactive and cumulative manner. While the formation of basic literacy skills may begin by language instruction within a specific context, literacy may also be nurtured and developed through practice engagement in a variety of contexts. Reder (1994) terms the latter as *practice engagement theory*.

Through a continued acquisition and development across a variety of contexts, literacy skills may become reinforced and increasingly flexible such that the ability to function in environments requiring the use of literacy improves. In other words, by experiencing and practicing literacy in a number of contexts, one's level of literacy may reach higher levels of functionality, which transcends a number of different contexts. For example, research indicates that reading a variety of print contents co-varies with literacy proficiency, as measured through functional means (Smith, 1996).

With regard to literacy assessments, higher performance on the administered instruments indicates a higher level of literacy as well as more flexibility and adaptability in applying literacy related know-how in terms of these specific tasks. In the case of IALS, efforts were made to develop literacy task items that were deemed to be adequately representative of typical literacy related situations, which one would be expected to encounter. An evaluation using literacy scores along a continuum indicates a certain level of literacy related know-how in terms of the complexity of literacy related situations as well as a certain capability of applying [or transferring] that know-how to other similar literacy related situations. Using Item Response Theory (Kirsch, Jungeblut & Mosenthal, 1998), the IALS literacy proficiency scores are estimated by setting

the probability of a respondent being able to perform successfully on a similar item of equivalent difficulty at 80 per cent.

The next two sections elaborate on the potential influence of a variety of contexts on literacy proficiency.

3. Education and literacy

There are numerous studies that have highlighted the importance of educational attainment in predicting adult literacy proficiency (e.g., Kirsch, Jungeblut, Jenkins & Kolstad, 1993; Raudenbush & Kasim, 1998; OECD & Statistics Canada, 2000; Boudard, 2001). Reder (1998) terms the effect of education on literacy the 'literacy development effect'.

Using structural analyses that take into account reading practices both at home and at work, language status and parent's education, Boudard (2001) finds that educational attainment continues to be the strongest predictor of literacy proficiency among the adult populations of 10 countries. Employing alternate analytical methods with additional predictors, OECD and Statistics Canada (2000) as well as Raudenbush and Kasim (1998) report similar results. In the former study, educational attainment is reported to be the strongest factor for 17 out of 20 countries participating in the International Adult Literacy Survey. Language status was reported to have a stronger effect for Australia and Switzerland, while occupational status was the strongest factor for Germany.

The significance of educational attainment in predicting adult literacy proficiency comes as no surprise since in most societies a principal goal of initial schooling is to produce a population able to read and write. While primary schools are usually responsible for teaching basic literacy skills, secondary schools emphasize the use of these skills for learning specific content. The International Association for the Evaluation of Educational Achievement (IEA) makes a distinction between these two stages, namely 'learning to read' and 'reading to learn' (Campbell, Kelly, Mullis, Martin & Sainsbury, 2001). In general, it is assumed that school contexts are characterised by classroom reading practices and routines that are conducive to language instruction as well as motivation in using literacy resources.

A number of studies provide insight into how specific school factors may help to develop children's reading abilities. In particular, results from the 1990-91 Reading Literacy Study, a comparative IEA study conducted in some 50 countries, suggest that in general, after controlling for economic and social conditions, hours of instruction per week, language teaching and the use of reading tests lead to higher literacy achievement among primary school students aged nine (Elley, 1992: 39). While reading practices and resources, such as the

frequency of silent reading in class, the frequency of borrowing books from the library and the size of libraries, appear to be important among students aged nine, they appear to be more important at the secondary level than instruction time (Elley, 1992: 39,47). These latter findings emphasize the difference between the stages of 'learning to read' and 'reading to learn'.

Reading practices closely associated with schooling but occurring outside the classroom context are also important in fostering literacy. Research by Loertscher (1993) and Simmons (1994) suggests that having access to appropriate library resources and good guidance from librarians fosters secondary school student's reading skills. In the IEA study, countries where secondary students of age 14 have access to more resources for reading as well as larger libraries, on average tend to achieve higher reading results (Elley, 1992: 47). Furthermore, Siegel and Hanson (1992) point out that extra-curricular activities among secondary school students occurring both in and out of school are potentially important contexts for developing literacy.

4. Beyond the classroom: Lifewide and Lifelong Learning contexts

Even though formal education is observed to have a strong influence on adult literacy proficiency, there are a number of other factors that may also play an important role in the acquisition, development, maintenance, or even depreciation of literacy proficiency throughout the lifespan. This is evidenced by the imperfect relationship that is observed between education and literacy. Such factors can include those that are associated with one's social and cultural context, individual characteristics such as one's health status, age, gender and motivation as well as current and previous experiences. These factors are not unrelated, however, social, cultural and individual factors are thought to strongly influence and define learning contexts as well as the nature and manner in which individuals interact with their environment (Brown, Collins & Duguid, 1989).

In this study, an emphasis is placed on learning that may occur in the home, school, work, leisure and community contexts. Through continued learning in different contexts, people can complement their previous educational experience, which can enhance their literacy skills along a continuum. Furthermore, it is also possible for people to compensate or substitute for low levels of education through learning and other experiential contexts beyond formal education. In contrast, the absence or lack of nourishing contexts can potentially lead to a depreciation of literacy skills.

The accumulation of literacy related know-how, which may occur as a result of engaging and interacting in a variety of contexts, occurs throughout the

lifespan, or more specifically across both the lifewide and lifelong perspectives of the lifelong learning concept. Lifelong learning concepts and theories (Dave, 1976; Cropley, 1980; Aspin, Chapman, Hatton & Sawano, 2001) can form a useful framework from which to consider learning contexts beyond formal education. The framework conveniently distinguishes among successive stages in which learning occurs such as in early childhood, primary, secondary and tertiary schooling as well as adulthood. This naturally forms a time perspective and hence the term lifelong. Learning also occurs in different contexts at every stage such as in the home, school, work, community and other; therefore, an element of space is added to the framework, where this is often referred to as the lifewide learning perspective.

As individuals progress through some of the typical stages of life, from early childhood, primary school, secondary school, tertiary school and work contexts, literacy demands also change. For example, Guthrie and Greaney (1991) suggest that literacy demands increase exponentially as the individual proceeds through the various levels of schooling. Beyond schooling, career choice may have a significant effect on the extent of further or reduced literacy demands. Careers or jobs typically demanding low levels of literacy engagement may exert a negative effect on the development or even maintenance of literacy proficiency. Even a stable job environment that demands the use of literacy to successfully carry out tasks, may lead to reduced literacy proficiency. Engaging only in a narrow range of specific literacy tasks, may not contribute to the development of functional literacy, and may even lead to its depreciation. In contrast, literacy rich work environments, with a variety of print contents, which consistently need to be understood to not only carry out the tasks but to define their direction may lead to enhanced literacy proficiency.

While work contexts may significantly contribute to the maintenance, development or reduction of literacy proficiency in adulthood, other contexts such as the home, family, leisure or community contexts may also be instrumental. From an economic point of view, other contexts may serve to compensate or substitute for a lack of engagement in the workplace. But conversely, the influence of work contexts on adult literacy may significantly affect other personal, social or cultural aims. Depending on career choice, engaging in literacy related practices and behaviours outside the work environment might be more important for some than others in contributing to the maintenance or development of adult literacy proficiency. The next section discusses a number of literacy determinants suggested to be important by previous research.

5. Correlates of Literacy

5.1 Age

Age reflects the time dimension in the lifelong learning framework. More generally, age is associated with distinct stages of learning. Furthermore, the timing of each stage and learning contexts are not independent from each other. For example, in early childhood, the home context plays a predominant role in the development of a child. While this persists well into the schooling years and even into adulthood, the schooling context begins to take on a larger role as time progresses. Similarly, in adulthood, the work context becomes increasingly relevant, while schooling contexts can be replaced with intermittent spurts of adult education and training contexts. It is not only the learning contexts that change with age, however; individuals also change, not least in the biological sense, but also with regard to their attitudes, behaviours and abilities (Baltes, 1987).

Findings from the IALS suggest that older age groups tend to have lower literacy proficiency than younger adults (OECD & Statistics Canada, 2000: 34). This corroborates with some of the research on reading comprehension and aging (Meyer, Young & Bartlett, 1993). There may be a *cohort effect*, since higher proportions of younger populations have received extended formal schooling compared to older populations. But younger adults may also have the benefit of more recent schooling. The latter implies a *recency effect*, suggesting that as time advances, the literacy skills of an individual can diminish, at least from what it may have been at the time of school completion. Some research on cognitive development supports the hypothesis of a *recency effect*. As time progresses, individuals may experience reduced cognitive performance, including declines in attentional capacity, processing speed, reasoning, working memory capacity and spatial ability (Smith & Marsiske, 1997).

While diminished cognitive mechanics may in part explain the negative relationship between literacy proficiency and age, older persons can also benefit from more practice or experience in a particular domain (Baltes, 1987). Indeed, studies suggest that experience can lead to an accumulation of knowledge and skills until an advanced age, when they may level off (Horn & Hofer, 1992; Schaie, 1994; Marsiske & Smith, 1998). The outcome of the interaction between cognitive mechanics and pragmatics invariably depends on the extent and nature of experience. Therefore, more frequent and intense engagement in different literacy related activities or behaviours throughout the lifespan might

offset some of the negative effects of aging on literacy proficiency (Smith, 1993).

5.2 *Home background*

A child begins to learn within the home and family environment. While this continues well into the schooling years and beyond (Bloom, 1964; Kreppner & Lerner, 1989), the educative climate of the home may exert most of its influence in the early years of childhood (Bloom, 1964: 121). The home is not only a learning environment for the child, however, it also plays an important role in shaping one's affective state in other learning environments, including schools and other contexts (Hess & Holloway, 1984). It may also influence opportunity and access to nourishing environments in terms of acquiring knowledge and skills as well as attitudes, values and behaviours, which facilitate the acquisition of knowledge and skills.

There are many different but related terms, which are used to reflect the educative value of the home and family environment. Among others, social background, socio-economic status, socio-cultural level, socio-psychological environment, the status and prestige of parents' occupation are all closely related concepts. In this paper, the term home background is used to reflect the potential educative impact of the home and family environment. It is a complex concept that is not easily measured for the purposes of analyses. Bloom (1976) implies that it may be gauged by three separate components, which may be amenable to measurement, namely a cultural, social and economic component. A synthesis of eighteen studies by Iverson and Walberg (1982) suggests that ability and achievement are more closely associated with the socio-psychological environment of the family than the socio-economic status.

A number of studies have suggested that the home background is an important factor influencing educational attainment as well as the development of competencies (Moos, 1991). For example, Elley (1992: 66) reports an overall positive association among all countries between the number of books in the home and literacy achievement of students. Raudenbush & Kasim (1998) demonstrate using the National Adult Literacy Survey data that in the United States the social component of home background as measured by the education and occupational prestige of the parents is an important predictor of the observed inequality in adult literacy proficiency. Furthermore, results reported in OECD and Statistics Canada (2000: 32) show that there is a consistent and positive association between literacy proficiency and parents' years of schooling in all of the countries participating in the IALS.

5.3 *Language status*

Perhaps with the exception of how it relates to numbers, literacy is bounded by language. Even in the former situation, success in using printed material to perform simple calculations often depends on language, since numbers are likely to be embedded in text. As such, one's proficiency in a language is naturally related to one's performance in literacy-oriented tasks. Since it is usually assumed that one is more proficient in their native tongue than in a foreign tongue, having a native language different than the language of the literacy test administered presumably results in lower performance. Using the 1991 IEA reading literacy survey, Elley (1992: 59) reports that students with a home language different than that used in school demonstrate lower literacy proficiency. Similar results are observed among the adult populations of the countries participating in the IALS. In many countries, foreign-born non-native speakers demonstrate lower literacy proficiency (OECD & Statistics Canada, 2000: 51-52).

5.4 *Gender*

While economic research has shown that gender is an important factor explaining wage differentials, the evidence with regard to differences in literacy outcomes indicates little association. In fact a number of studies within the context of advanced industrialized countries show that there are very few differences in literacy between men and women (Kapsalis, 1997; Lynch, 1992; Raudenbush & Kasim, 1998; Tuijnman & Boudard, 2001). But within a structural framework, gender is likely to have an impact on occupational choice (Stromquist, 1997; Strober, 1997) and other decisions that may influence the acquisition of literacy, or at least differences in the mechanisms by which literacy is maintained or enhanced. As such, gender is included in the model as a correlate of literacy.

5.5 *Labor force status*

In most countries, a large proportion of the adult population between the age of 25 and 65 are part of the labour force. This includes both the employed and unemployed looking for work as per the definition of the International Labour Organization. Others may be in early retirement, studying, taking care of family or doing other activities. While both labour force participants and non-participants are exposed to home, community and other learning contexts, those in the labour market are also exposed to the work environment. Moreover, time

is limited, so individuals must allocate their time among a variety of possible contexts including work, home, community and others. Because the nature and type of activities that individuals will perform within each context is likely to vary substantially, the mechanism by which individuals develop, maintain or diminish their literacy, may depend on their labour force status.

Evidence suggests that those who are employed have consistently higher literacy proficiency than those outside of the labour force (OECD & Statistics Canada, 2000: 37-38, 63). But the results can be confounded, since those outside the labour force include students over 25, home makers, and retirees less than 65. IALS results show that those who study tend to be more proficient, while retirees demonstrate lower proficiency. Furthermore, within the labour force the unemployed consistently perform at lower levels than the employed population. Similarly, employed workers who work fewer weeks tend to demonstrate lower levels of literacy proficiency than those who work more often. In summary, evidence from the IALS suggests that those who are fully employed tend to be more literate. While the direction of causality for this observed relationship is unknown, it is plausible to hypothesize that the work environment provides many with an opportunity to develop or maintain literacy proficiency.

The nature of the work environment is likely to be critical in determining the extent to which it nurtures literacy. For example, occupations dominated by tasks that require the processing of information are more likely to enhance literacy skills than those that deal primarily with physical labour. IALS findings (e.g., OECD & HRDC, 1997: 53; OECD & Statistics Canada, 2000: 66-73) show that most individuals who exhibit relatively high literacy proficiency are employed in white-collar occupations requiring high levels of skill. In the case of Canada, Boothby (1999) and Massé, Roy and Gingras (2000) explore this further and highlight that those with the highest levels of literacy are concentrated in occupations requiring a high degree of knowledge practice. Selection bias makes it difficult to infer causation, but on the basis of practice engagement theory, it is reasonable to hypothesise that work environments involving knowledge practice and literacy engagement provide a nurturing environment to develop or maintain cognitive abilities such as literacy skills.

5.6 *Literacy practice at work and at home*

Depending on labour force and occupational status as well as a variety of other factors, individuals will engage in literacy practice in varying frequency, variety, criticality and intensity. An important theory discussed by Reder (1994), namely *practice engagement theory* suggests that individuals acquire

literacy through participation in different literacy practices. According to this theory, those who engage more in literacy practice both at work and at home will enhance or at least maintain their literacy skills. A related hypothesis involves the ‘use it or lose it’ proposition discussed by Krahn and Lowe (1998).

There are four general features of literacy practice that Jones (1999) outlines, namely occurrence, variety, involvement and criticality. In principle, the measures used to indicate literacy practice in this study, properly distinguishes the occurrence and variety of literacy practice. But the frequency measures used are confounded with involvement and criticality. Thus it is difficult to differentiate between those who merely scan printed material or those that spend extended time reading and writing. It is also not possible to properly differentiate between the criticality of reading and writing tasks. This latter issue is particularly important with regard to literacy practice at work.

Although it is not possible to verify with any certainty, involvement and criticality are more likely to be relevant to literacy practice at work, and especially among white-collar high skill occupations such as professionals, managers and technicians. In general, literacy activities may be more important for job performance among these latter occupations.

The variety of print contents is also an issue. Smith (1996) suggests that regardless of the purpose or context in which reading occurs, those who read many different print contents will demonstrate higher literacy proficiency than those who read few contents. In this study, a variety of print contents are incorporated into the analyses. Moreover, a variety of activities involving literacy related activities are also incorporated. There is one latent variable measuring the frequency and variety of literacy practice at work and two latent variables related to the frequency and variety of literacy practice outside the work environment. The latter includes one variable measuring the frequency of reading current events and another more general variable measuring literacy practice at home. See Table 1A for a description of the variables used in the analysis.

A number of studies suggest that literacy practice is associated with higher literacy skills. For all countries participating in the IALS, those who engage more frequently in literacy practice at work also demonstrate higher literacy proficiency (OECD & HRDC, 1997: 82-84; OECD & Statistics Canada, 2000: 38-41). Meissner (1971) and Rubenson (1987) as well as many other studies also suggest this relationship for literacy practice at home and more generally in daily life. Studies focusing on school age children also support this hypothesis, by showing an association between reading achievement and time spent reading as well as having easy access to books both in the community and at home (e.g.,

Anderson, Wilson & Fielding, 1988; Taylor, Frye & Maruyama, 1990; Elley, 1992).

5.7 *Adult education and training*

While adult training usually refers to learning focused on providing the knowledge or improving the skills currently required by job or professional activities, adult education is broader as it may involve learning associated with a future job or other personal development (Rubenson & Schuetze, 1995). For the purposes of the analysis undertaken in this paper, adult education and training are more or less treated as equivalent, because the IALS did not differentiate between the two. Instead, separating adult education and training into whether the decision to participate was for job-related reasons or non-job related reasons is the differentiation made in this analysis.

The nature and purpose of adult education and training can vary substantially. While some programs are designed as basic skills education, others are of a more advanced nature. Regardless of the type of adult education and training, there is a general expectation that this kind of organized learning will involve literacy related activities and hence be associated with literacy proficiency. But even for basic adult literacy education programs, the evidence of success in improving the skills and practices of adult learners are inconclusive (Sheehan-Holt & Smith, 2000). Despite these inconclusive results, adult education and training potentially exposes adults to environments that require the use of printed material and through practice engagement theory, this may lead to enhanced literacy skills.

Adult education and training contexts differ markedly from schooling contexts in their duration. The practice of literacy within a particular context for an extended period of time may be necessary, especially in the early stages of developing literacy skills, in order to successfully transfer skills that may be learned in one context to another. This may in part explain the difference between the observed relationship between education and literacy proficiency in contrast to some of the evidence concerning the relationship between basic skills education and literacy proficiency.

Excluding basic skills programs, the causal effect may very well be in the other direction. That is, literacy proficiency may be an important factor predicting participation in adult education and training. For example, Boudard (2001) finds that literacy proficiency among the male population between 25 and 55 in seven countries participating in the IALS has a significant effect on participation in recurrent training. In the case of employer sponsored training, this makes sense, since employers are likely to invest in those, which they feel

are most likely to learn. Good foundation skills, and more specifically, literacy skills are essential for individuals to participate in adult education and training based on instructional methodologies that are print based. Therefore, it may be that those who demonstrate or signal relatively high levels of literacy proficiency are more likely to receive further training. Regardless, the focus of this study is on the determinants of literacy; therefore, the hypothesis that adult education and training may predict literacy proficiency is maintained.

5.8 Other literacy related behaviours

There are a number of other factors including activities in daily life that occur outside of the work environment, which may affect the acquisition, maintenance or development of literacy. Being involved in voluntary and community-based activities is one such activity that is expected to have an educative impact (Elsdon, 1991). Voluntary and community-based activities are known from research to co-vary with literacy-rich environments. Indeed, such participation can stimulate the development of new skills as well as preventing others from being lost due to lack of use. OECD and HRDC (1997: 56-57) shows that those who participate in voluntary activities at least once a month are associated with high levels of literacy proficiency.

Watching television can potentially complement the practice of literacy in daily life, but it can also act as a substitute. Excessively using the television as means to obtain information about current events instead of reading newspapers or magazines can potentially lead to a deterioration of literacy skills. This follows from the 'use or lose it' hypothesis (Krahn & Lowe, 1998), which maintains that failure to use literacy skills in daily life can lead to a depreciation of those skills. Some evidence has shown that hours of watching television are negatively related to literacy proficiency (Kirsch & Jungeblut, 1997; OECD & HRDC, 1997: 77-84).

6. Structural model predicting literacy proficiency

Based on the theories and findings already discussed, Figure 1 summarizes a set of hypotheses into a single linear model, which specifies a causal structure that may underlay adult literacy proficiency. The purpose of the model is to disentangle the influences of various factors and to estimate the extent to which each may contribute to the development of literacy proficiency, while at the same time accounting for the interaction among some of the factors included in the model. In so doing, causal directions among the factors are hypothesized. These are merely hypotheses advanced on the basis of theory and previous

research. The findings do not in themselves prove or disprove the hypotheses, but provide reasonable support for or against the specification. A good fit of the model suggests a reasonable specification amongst alternative specifications.

The following are some important research questions addressed by the model:

1. What is the structure underlying adult literacy proficiency?
2. What factors influence performance on adult literacy proficiency measures?
3. Is it possible to identify general relationships between important factors and literacy proficiency across countries?

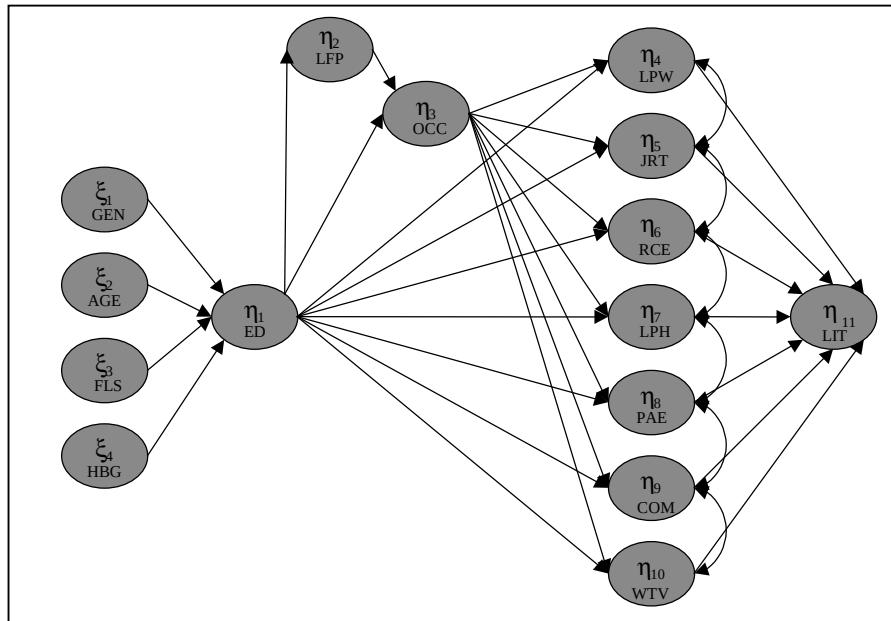


Figure 1. Structural model of literacy determinants

Notes:

- | | |
|---|---|
| ξ_1 indicates gender (GEN); | η_5 indicates participation in job-related training (JRT); |
| ξ_2 indicates age (AGE); | η_6 indicates engagement in reading current events (RCE); |
| ξ_3 indicates non-native language status (FLS); | η_7 indicates literacy practice at home (LPH); |
| ξ_4 indicates home background (HBG); | η_8 indicates part. in personal interest adult ed. (PAE); |
| η_1 indicates initial formal education (ED); | η_9 indicates engagement in community (COM); |
| η_2 indicates labour force participation (LFP); | η_{10} indicates the frequency of watching television (WTV); |
| η_3 indicates knowledge intensity of occupation (OCC); | η_{11} indicates literacy skill (LIT); |
| η_4 indicates literacy practice at work (LPW); | |
- See Table 1A for further details.

Initially the model introduces factors that are not easily influenced such as gender, age, language status and home background, but can significantly affect learning experiences, attitudes, behaviours, opportunities and choices. These factors are treated as strictly independent in the structure. Implicit in the structure of the model is time, which can be read from left to right, such that factors positioned to the right of other factors occur at a later time. This is a necessary condition to establish causation. Because the IALS is a cross sectional survey as well as other practical limitations, some of the inherent reciprocal and dynamic relationships among the factors considered cannot be taken into account. For example, the cumulative effect of continued learning in adulthood on literacy proficiency cannot be accounted for, perhaps leading to an underestimation of the relative effect of the job and other literacy related factors occurring in adulthood.

The model places an emphasis on the lifelong and lifewide learning perspectives. Although the IALS is a cross sectional dataset, background information allows for some of the prior learning associated with home and schooling contexts to be taken into account. This reflects elements of both the time (lifelong) and context (lifewide) of prior learning. Other background information, which potentially reflects continued learning that occurs in the work, home, community and leisure contexts, allows for recent and by assumption recurring learning activities occurring across the lifewide learning dimension and throughout adulthood to be taken into account. As such, the model allows for comparisons of the potential impact of different learning on adult literacy proficiency, which can be anchored within a lifelong-lifewide learning framework.

While both are stock measures that have occurred in the past, it is convenient to view the home background as originating before education. In general, the two continue to interact throughout the schooling years, but for recursive modelling purposes the causation is hypothesized in one direction only. Furthermore, the home background and education reflect distinct contexts that may have contributed to literacy proficiency before the age of 25. Beyond the age of 25, a variety of literacy related factors associated with the work, home and community contexts are included in the model.

For convenience, a set of factors associated with the work environment is referred to as the 'job', whereas the remaining factors are referred to as 'other' literacy related factors. The latter captures some of the potential influence that home, community and leisure contexts may have on literacy proficiency in adulthood. In general, the factors considered beyond the age 25 are current flow measures, which are taken to be reflective of ongoing activities recurring throughout adulthood.

The following is a summary of the major hypotheses implied by the structural model:

1. The quality of one's home background, the amount of education one completes, the kind of job one is currently employed in and other positive literacy related behaviours are important factors influencing literacy proficiency.
2. The quality of one's home background influences the amount of education one completes, the kind of job one is currently employed in and other positive literacy related behaviours.
3. Education influences the kind of job one is currently employed in and other positive literacy related behaviours.
4. Labour force status and the kind of job one is currently employed influences other positive literacy related behaviours.
5. The amount of education one completes complements the influence that the quality of one's home background may exert on literacy proficiency.
6. The kind of job one is currently employed in complements the influence that education may exert on literacy proficiency.
7. Other positive literacy related behaviours complement the influence that education may exert on literacy proficiency.

7. Analytical method and data

A Structural Equation Modelling (SEM) method of analysis, namely Linear Structural RELations (LISREL), is used to estimate the hypothesized structural model. The LISREL method allows for a measurement model to be specified in concurrence with a structural model. This procedure is advantageous because a measurement model allows for important and often complex factors, which may not be possible to directly observe or measure, to be estimated as latent variables using multiple indicators. Moreover, in this framework, the measurement errors of observed variables can be taken into account when estimating a system of structural relationships. For a full derivation of the LISREL model see Jöreskog (1969) and for a summary of the theory guiding the application of LISREL see Jöreskog and Sörbom (1990) and Tuijnman and Keeves (1997).

The model is fitted to the datasets using a Maximum Likelihood (ML) fit function. The structural parameter estimates reported throughout are completely standardized such that they are standardised maximum likelihood regression weights. This allows for a meaningful comparison of estimates among all factors considered even though the non-standardized scales and distributions may vary from one variable to another.

Prior to estimating the structural and measurement model, a polychoric correlation matrix, which includes all the indicators used to specify the model, was computed using a pre-processor to the LISREL program called PRELIS. Because the indicators used range from dichotomous, ordinal and continuous (interval-scaled) type variables, they inherently possess different measurement properties. As such, three different types of correlations were computed to optimize the measurement properties of the correlation matrix. The three estimation functions used to compute the correlations include the product-moment, polychoric, and polyserial correlation functions.

Table 1A lists all the indicators of the measurement model in relation to the variables used to estimate the structural model. Variables included in the structural model that are linear combinations of more than one indicator are by definition latent constructs. There are six variables in the measurement model estimated as latent constructs: home background, education, literacy practice at work, reading current events, literacy practice at home and literacy proficiency. As much as possible the same comparable indicators are used for each country. In a few cases, there are fewer measures indicating the same latent construct because of data availability. For literacy practice at work, the indicators vary for the Czech Republic and Italy in order to improve the reliability of the latent construct. It is also an indication that literacy practice at work in these two countries, are different than all the other countries considered. In Table 1B, select descriptive statistics for each indicator used in the structural analysis are reported by country. Similarly, Table 1C reports the standardized factor loadings for each of the indicators forming latent variables.

The model is fitted to 18 of the country datasets available in the International Adult Literacy Survey (IALS). The IALS was an international comparative assessment of adult literacy proficiency that also collected comparable background information. See Murray, Kirsch and Jenkins (1998) for a detailed description of the methodology used in the IALS. Only adult populations aged 25 to 65 are considered in this analysis. Those aged less than 25 are excluded because the IALS does not allow for proper distinction of full- and part- time students. Moreover, the interpretation of the structural model partly relies on the assumption that for those over the age of 25, the work, home, and community contexts are more relevant than schooling contexts. It is assumed that in many countries, schooling and other educational contexts remain relatively important for a large proportion of the population under the age of 25.

Table 1A. Latent and observed variables employed in the structural analysis

Latent Variables			Observed Variables	
Label	Abb		Description	Type
ξ_1 Gender	GEN	X_3	Gender	Dichotomous
ξ_2 Age	AGE	X_2	Age	Continuous
ξ_3 Foreign language status	FLS	X_1	Mother tongue and language of test	Dichotomous
ξ_4 Home background	HBG	X_4	Fathers' level of educational attainment	Ordinal
		X_5	Mothers' level of education attainment	Ordinal
		X_6	Fathers' occupational status	Ordinal
η_1 Education	ED	Y_1	Highest level of schooling completed	Ordinal
		Y_2	Years of formal education completed	Continuous
η_2 Labour force participation	LFP	Y_3	Labour force participation	Dichotomous
η_3 Occupational status	OCC	Y_4	Occupational status	Ordinal
η_4 Job-related training	JRT	Y_{10}	Participated in job-related training	Dichotomous
η_5 Literacy practice at work	LPW	Y_5	Reading letters or memos	Ordinal
		Y_6	Reading reports, articles, magazines, or journals	Ordinal
		Y_7	Reading manuals or reference books including catalogues	Ordinal
		Y_8	Writing letters or memos	Ordinal
		Y_9	Writing reports or articles	Ordinal
η_6 Reading current events	RCE	Y_{11}	Reading newspapers or magazines	Ordinal
		Y_{12}	Following current, government and public affairs by reading newspapers	Ordinal
		Y_{13}	Following current, government and public affairs in general	Ordinal
η_7 Literacy practice at home	LPH	Y_{16}	Intensity of using a library	Ordinal
		Y_{17}	Intensity of writing letters or anything else that is more than one page in length	Ordinal
		Y_{18}	Intensity of reading books	Ordinal
η_8 Personal-interest related adult education	PAE	Y_{19}	Participation in personal-interest related adult education	Dichotomous
η_9 Community participation	COM	Y_{15}	Community participation	Ordinal
η_{10} Watching television	WTV	Y_{14}	Watching television	Ordinal
η_{11} Literary proficiency	LIT	Y_{20}	Document literacy proficiency	Continuous
		Y_{21}	Prose literacy proficiency	Continuous
		Y_{22}	Quantitative literacy proficiency	Continuous

Source: International Adult Literacy Survey, 1994-1998.

Table 1B. Descriptive statistics of observed variables employed in the structural analysis

		Australia			Belgium			Canada			Chile		
		mean	s.dev	n	mean	s.dev	n	mean	s.dev	n	mean	s.dev	n
ξ_1	X ₁	0.16		6961	0.03	0.18	1540	0.12	0.33	3307			
ξ_2	X ₂	42.38	11.11	6961	42.5	11	1540	42.21	10.77	3307	41.23	11.02	2780
ξ_3	X ₃	0.50	0.50	6961	0.48	0.5	1540	0.49	0.50	3307	0.49	0.50	2780
ξ_4	X ₄	3.29	1.43	5458	2.81	1.28	1395	2.93	1.59	2729	2.20	1.43	2224
	X ₅	2.98	1.21	5503	2.5	1.07	1385	2.98	1.44	2822	1.96	1.27	2360
	X ₆	4.90	2.63	6605				4.69	2.45	3120	3.75	2.42	2300
η_1	Y ₁	1.78	0.90	6961	1.5	1.56	1540	2.90	1.15	3307	2.25	1.09	2780
	Y ₂	11.75	3.56	6961	11.9	3.53	1540	12.39	4.02	3307	9.36	4.41	2780
η_2	Y ₃	0.76	0.43	6961	0.73	0.44	1536	0.75	0.43	3306	0.67	0.47	2780
η_3	Y ₄	4.66	2.29	5298	4.28	1.12	933	4.90	2.28	2342	3.48	2.07	1803
η_4	Y ₅	3.75	1.62	5326	3.41	1.72	1108	3.74	1.60	2334	2.27	1.70	1818
	Y ₆	3.10	1.66	5326	3.02	1.68	1108	3.19	1.68	2333	2.45	1.69	1818
	Y ₇	3.07	1.58	5326	2.66	1.53	1103	2.96	1.65	2334	2.26	1.58	1818
	Y ₈	2.75	1.67	5326	2.98	1.74	1106	3.11	1.72	2335	2.21	1.68	1818
	Y ₉	2.15	1.47	5326	2.21	1.52	1104	2.62	1.68	2336	2.03	1.56	1818
η_5	Y ₁₀	0.30	0.46	6961	0.14	0.35	1540	0.29	0.45	3307	0.12	0.32	2780
η_6	Y ₁₁	4.52	0.87	6961	4.35	1.01	1523	4.42	0.95	3268	3.72	1.44	2777
	Y ₁₂							3.18	0.90	3292	2.54	1.09	2773
	Y ₁₃							3.41	0.90	3295	2.64	1.15	2780
η_7	Y ₁₄				2.97	1.11	1531	3.00	1.12	3292	3.08	1.07	2780
η_8	Y ₁₅	1.83	1.22	6961	1.73	1.19	1523	1.86	1.14	3297	1.68	1.17	2775
η_9	Y ₁₆	1.80	1.08	6961	1.7	0.98	1527	1.81	1.04	3299	1.21	0.67	2779
	Y ₁₇	2.42	1.27	6961	1.78	1.11	1522	2.16	1.18	3296	1.87	1.27	2778
	Y ₁₈	3.35	1.55	6961	2.52	1.4	1529	3.29	1.56	3297	2.52	1.49	2775
η_{10}	Y ₁₉	0.08	0.28	6961	0.06	0.25	1540	0.06	0.24	3307	0.07	0.26	2780
η_{11}	Y ₂₀	270.6	64.60	6961	273	55.5	1540	276.1	72.64	3307	213.2	53.18	2780
	Y ₂₁	271.9	65.54	6961	267	56.3	1540	277.0	66.37	3307	214.8	52.51	2780
	Y ₂₂	275.0	63.06	6961	278	62.2	1540	280.5	66.87	3307	202.5	67.52	2780

Source: International Adult Literacy Survey, 1994-1998.

Table 1B (cont'd). Descriptive statistics of observed variables employed in the structural analysis

		Czech Republic			Denmark			Finland			Hungary		
		mean	s.dev	n	mean	s.dev	n	mean	s.dev	n	mean	s.dev	n
ξ_1	X ₁	0.01	0.10	2692	0.01	0.1	2497	0.02	0.12	2373	0	0.05	2067
ξ_2	X ₂	44.59	10.63	2692	43.2	11.2	2497	43.87	11.01	2373	43.6	11.3	2067
ξ_3	X ₃	0.49	0.50	2692	0.49	0.5	2497	0.50	0.50	2373	0.48	0.5	2067
ξ_4	X ₄	3.20	1.08	2474	3.72	0.99	2404	2.71	1.34	2169	3.15	1.22	1859
	X ₅	2.73	0.97	2512	3.4	0.95	2432	2.61	1.22	2238	2.82	1.05	1929
	X ₆	5.09	2.31	2298				4.30	2.50	2103	4.19	2.61	1861
η_1	Y ₁	1.45	0.86	2691	1.95	1.06	2497	1.85	0.85	2373	2.83	0.78	2067
	Y ₂	12.54	2.79	2692	13	3.4	2497	12.24	3.88	2373	11.8	3.48	2064
η_2	Y ₃	0.77	0.42	2691	0.81	0.39	2497	0.79	0.41	2373	0.67	0.47	2067
η_3	Y ₄	4.51	2.28	2103	4.85	2.11	2031	5.06	2.27	1794	4.42	2.32	1239
η_4	Y ₅	2.95	1.71	2120	4.1	1.44	2079	3.70	1.51	1851	3.03	1.8	1269
	Y ₆	2.94	1.65	2117	3.31	1.56	2078	3.60	1.47	1849	2.89	1.78	1269
	Y ₇	2.64	1.51	2117	2.98	1.55	2075	2.91	1.50	1848	2.58	1.6	1268
	Y ₈	2.69	1.67	2117	3.68	1.63	2078	2.99	1.62	1849	2.89	1.78	1267
	Y ₉	2.33	1.60	2117	2.26	1.53	2078	2.42	1.50	1849	1.31	0.92	1268
η_5	Y ₁₀	0.20	0.57	2692	0.49	0.5	2497	0.39	0.49	2373	0.13	0.33	2055
η_6	Y ₁₁	4.67	0.68	2686	4.73	0.64	2491	4.89	0.41	2371	4.54	0.93	2064
	Y ₁₂	3.25	0.79	2689				3.54	0.65	2371	3.08	1.12	2055
	Y ₁₃	3.67	0.64	2692				3.66	0.67	2370	3.25	0.96	2061
η_7	Y ₁₄	3.30	1.04	2690	3.25	0.8	2496	3.22	0.97	2372	3.28	1	2060
η_8	Y ₁₅	1.67	0.89	2662	1.88	1.26	2494	1.87	1.05	2367	1.57	0.8	2062
η_9	Y ₁₆	1.59	0.92	2687	2.03	1.07	2496	2.37	1.00	2366	1.41	0.82	2061
	Y ₁₇	2.26	1.12	2684	1.96	1.12	2495	1.91	1.00	2369	2.18	1.24	2061
	Y ₁₈	3.48	1.31	2692	3.17	1.54	2492	3.15	1.36	2370	3.19	1.45	2063
η_{10}	Y ₁₉	0.05	0.46	2692	0.13	0.33	2497	0.24	0.43	2373	0.06	0.23	2055
η_{11}	Y ₂₀	279.9	51.45	2692	294	45.1	2497	284.1	53.78	2373	244	53	2067
	Y ₂₁	266.6	41.31	2692	275	35.8	2497	283.4	48.25	2373	238	41.7	2067
	Y ₂₂	296.9	53.14	2692	300	43.6	2497	283.7	47.70	2373	267	53.7	2067

Source: International Adult Literacy Survey, 1994-1998.

Table 1B (cont'd). Descriptive statistics of observed variables employed in the structural analysis

		Ireland			Italy			Netherlands			New Zealand		
		mean	s.dev	n	mean	s.dev	n	mean	s.dev	n	mean	s.dev	n
ξ_1	X ₁	0.01	0.08	1854	0.01	0.09	2522	0.04	0.20	2512	0.26	0.44	3568
ξ_2	X ₂	42.19	10.91	1854	43.55	11.62	2522	42.35	11.31	2512	42.1	11.1	3568
ξ_3	X ₃	0.50	0.50	1854	0.49	0.50	2522	0.51	0.50	2512	0.49	0.5	3568
ξ_4	X ₄	2.45	1.09	1647	2.29	1.19	2443	3.09	1.29	2324	3.35	1.28	2200
	X ₅	2.43	0.96	1655	2.01	0.99	2441	2.61	0.96	2331	3.17	1.08	2233
	X ₆				4.03	2.38	2424						
η_1	Y ₁	2.34	1.05	1822	2.23	0.96	2522	1.62	0.97	2512	2.72	0.91	3541
	Y ₂	10.12	3.07	1853	10.07	4.40	2522	12.66	4.28	2512	12.1	2.8	3322
η_2	Y ₃	0.63	0.48	1850	0.64	0.48	2521	0.68	0.47	2512	0.76	0.43	2797
η_3	Y ₄	4.50	2.26	1062	4.46	2.15	1680	5.39	2.16	1739	4.59	2.09	2176
η_4	Y ₅	3.16	1.75	1095	2.94	1.75	1690	3.61	1.62	1752	3.64	1.63	2177
	Y ₆	2.76	1.58	1094	2.56	1.61	1690	3.36	1.61	1752	3.17	1.6	2177
	Y ₇	2.66	1.62	1092	2.62	1.61	1690	2.96	1.56	1752	3.06	1.58	2177
	Y ₈	2.93	1.73	1089	2.54	1.71	1691	3.02	1.68	1752	3.04	1.72	2177
	Y ₉	2.41	1.57	1091	1.82	1.34	1691	2.42	1.56	1752	2.41	1.54	2177
η_5	Y ₁₀	0.16	0.36	1850	0.16	0.37	2521	0.24	0.43	2511	0.38	0.49	2797
η_6	Y ₁₁	4.62	0.83	1848	4.20	1.09	2519	4.73	0.73	2511	4.61	0.76	2797
	Y ₁₂				2.96	1.00	2516	3.51	0.87	2511	3.37	0.77	2797
	Y ₁₃				3.38	0.93	2518	3.29	0.88	2511			
η_7	Y ₁₄	3.28	1.04	1851	3.41	0.94	2519	3.18	1.03	2511	3.28	1.05	2797
η_8	Y ₁₅	1.96	1.24	1845	1.43	1.01	2519	2.08	1.42	2511	2.14	1.31	2797
η_9	Y ₁₆	1.67	1.02	1851	1.30	0.67	2518	1.92	1.17	2511	2.16	1.12	2797
	Y ₁₇	2.41	1.22	1848	1.84	1.15	2517	2.12	1.15	2511	2.61	1.18	2796
	Y ₁₈	3.29	1.52	1845	2.65	1.51	2520	3.07	1.49	2511	3.66	1.4	2797
η_{10}	Y ₁₉	0.05	0.22	1850	0.05	0.22	2521	0.11	0.31	2511	0.09	0.28	2797
η_{11}	Y ₂₀	254.9	58.99	1854	232.8	62.23	2522	283.9	46.08	2512	267	57.1	3568
	Y ₂₁	261.3	57.21	1854	238.0	61.39	2522	280.6	43.61	2512	274	53.7	3568
	Y ₂₂	260.9	64.01	1854	243.6	64.19	2522	286.5	46.85	2512	270	56.3	3568

Source: International Adult Literacy Survey, 1994-1998.

Table 1B (cont'd). Descriptive statistics of observed variables employed in the structural analysis

		Norway			Poland			Slovenia			Switzerland		
		mean	s.dev	n	mean	s.dev	n	mean	s.dev	n	mean	s.dev	n
ξ_1	X ₁	0.05	0.22	2656	0.01	0.07	2363	0.09	0.29	2335	0.16	0.36	3653
ξ_2	X ₂	42.68	11.06	2656	42.6	11	2363	43.44	11.33	2335	42.73	11.37	3653
ξ_3	X ₃	0.52	0.50	2656	0.49	0.5	2363	0.50	0.50	2335	0.49	0.50	3653
ξ_4	X ₄	3.72	1.02	2497	2.37	1.18	2212	2.28	0.87	2114	3.67	1.15	3315
	X ₅	3.43	0.86	2548	2.14	1.04	2242	1.96	0.79	2167	3.17	0.95	3331
	X ₆				3.85	2.25	2181						
η_1	Y ₁	2.15	0.61	2650	2.27	1.03	2363	2.71	0.87	2335	2.94	0.77	3431
	Y ₂	11.78	2.82	2650	10.9	3.16	2362	11.06	3.26	2335	12.25	3.52	3514
η_2	Y ₃	0.83	0.37	2656	0.7	0.46	2362	0.76	0.43	2335	0.79	0.40	3512
η_3	Y ₄	4.97	2.10	2264	4.13	2.15	1573	4.31	2.15	1669	4.99	2.22	2652
η_4	Y ₅	3.85	1.46	2291	2.29	1.62	1588	2.77	1.75	1678	4.01	1.50	2707
	Y ₆	3.35	1.44	2291	2.08	1.42	1587	2.89	1.72	1677	3.52	1.60	2706
	Y ₇	2.85	1.48	2291	2.04	1.39	1587	2.31	1.50	1678	2.82	1.45	2703
	Y ₈	2.76	1.60	2290	2.19	1.59	1587	2.45	1.67	1678	3.79	1.60	2706
	Y ₉	2.18	1.43	2289	1.76	1.34	1586	2.17	1.49	1677	2.55	1.56	2703
η_5	Y ₁₀	0.44	0.50	2656	0.11	0.31	2363	0.25	0.43	2335	0.26	0.44	3518
η_6	Y ₁₁	4.92	0.37	2653	4.41	0.95	2340	4.61	0.76	2329	4.79	0.58	3476
	Y ₁₂							3.28	0.83	2330	3.47	0.82	2313
	Y ₁₃							3.29	0.94	2333	3.46	0.90	3465
η_7	Y ₁₄	3.13	0.96	2652	3.16	0.98	2359	3.14	1.03	2333	2.50	1.19	3473
η_8	Y ₁₅	1.99	1.19	2653	1.33	0.78	2348	1.56	1.02	2334	1.69	1.14	3474
η_9	Y ₁₆	1.59	0.89	2653	1.49	0.9	2359	1.71	1.00	2335	1.49	0.84	3477
	Y ₁₇	1.94	1.04	2653	1.92	1.01	2355	1.85	1.11	2334	2.38	1.20	3471
	Y ₁₈	2.98	1.50	2653	2.82	1.42	2358	2.79	1.39	2334	3.41	1.42	3474
η_{10}	Y ₁₉	0.06	0.25	2656	0.04	0.19	2363	0.09	0.29	2335	0.19	0.40	3518
η_{11}	Y ₂₀	294.3	50.94	2656	218	71.3	2363	224.4	66.18	2335	266.3	63.76	3653
	Y ₂₁	286.0	42.66	2656	223	58.7	2363	222.6	58.16	2335	260.0	55.45	3653
	Y ₂₂	296.3	46.86	2656	231	69.3	2363	236.6	68.63	2335	276.5	59.15	3653

Source: International Adult Literacy Survey, 1994-1998.

Table 1B (cont'd). Descriptive statistics of observed variables employed in the structural analysis

United Kingdom					United States		
		mean	s.dev	n	mean	s.dev	n
ξ_1	X ₁	0.05	0.22	5799	0.13	0.34	2475
ξ_2	X ₂	43.32	11.44	5799	43.4	11	2475
ξ_3	X ₃	0.50	0.50	5799	0.46	0.5	2475
ξ_4	X ₄	3.15	0.87	4623	3.74	1.38	1969
	X ₅	3.07	0.74	4765	3.68	1.2	2129
	X ₆				5.26	2.23	2072
η_1	Y ₁	1.54	0.88	5799	2.16	0.9	2465
	Y ₂	12.01	2.78	5799	13.4	3.24	2471
η_2	Y ₃	0.77	0.42	5799	0.79	0.4	2421
η_3	Y ₄	4.83	2.19	4007	4.97	1.91	1890
η_4	Y ₅	3.87	1.55	4048	3.82	1.62	1887
	Y ₆	3.10	1.55	4048	3.27	1.67	1882
	Y ₇	2.97	1.57	4047	3.28	1.64	1884
	Y ₈	3.12	1.73	4048	3.27	1.72	1882
	Y ₉	2.41	1.54	4048	2.69	1.65	1880
η_5	Y ₁₀	0.39	0.49	5799	0.38	0.48	2398
η_6	Y ₁₁	4.60	0.81	5791	4.42	1.04	2381
	Y ₁₂				3.2	0.91	2387
	Y ₁₃	3.25	0.92	5788	3.4	0.89	2389
η_7	Y ₁₄	3.51	1.01	5789	3.15	1.06	2370
η_8	Y ₁₅	1.70	1.11	5792	2.11	1.28	2386
η_9	Y ₁₆	1.92	1.03	5793	1.89	0.96	2391
	Y ₁₇	2.35	1.12	5792	2.25	1.17	2390
	Y ₁₈	3.23	1.54	5789	3.33	1.48	2372
η_{10}	Y ₁₉	0.10	0.30	5799	0.06	0.24	2398
η_{11}	Y ₂₀	265.8	66.45	5799	269	69.1	2475
	Y ₂₁	265.4	60.88	5799	276	66.3	2475
	Y ₂₂	267.9	65.62	5799	278	67.1	2475

Source: International Adult Literacy Survey, 1994-1998.

8. Estimation results

8.1 *Model fit*

The same general structural model was fitted to 18 country data sets. The standard procedure when fitting models using linear structural relations requires that you initially allow all paths to be open. Because this is a recursive model, with no reciprocal or dynamic possibilities, less than half of all possible paths² are initially estimated such that causation is inferred in one direction only. Paths that are found to be insignificant at the five per cent level are then closed in an iterative fashion starting with the left most factors and proceeding to the other factors in the order that they are placed in the sequencing of the model. Depending on whether they are found to be significant, recursive pathways are constrained to be zero in some country datasets while they are estimated in others; however, it is still the same general structure that is fitted to all country datasets.

In summary, the general structure of the hypothesized model fits all 18-country data sets relatively well. That is, all models are deemed to have a relatively good fit. Table 2 shows that the RMR is below 0.05 for all countries, which is an important criterion used to assess model fit (Tuijnman & Keeves, 1997). The other criterion of a GFI exceeding 0.90 is also met for every country (Hoyle & Panter, 1995; Tuijnman & Keeves, 1997). While it would be desirable to also have the AGFI over 0.90, there are only three models that achieve this criterion. The AGFI for the remainder of the countries ranges from 0.84 to 0.89. In summary, the results consistently show that the hypothesized structural model is reasonable relative to alternative specifications. This implies that while some specific paths may differ from country to country, the general hypothesized relationships among the major factors included in the analysis are relatively consistent across all 18 countries.

The coefficients of variation, which are measures indicating the proportion of the observed variance in literacy proficiency that can be explained by the factors included in the model, also indicate a good model. Table 2 shows that over 50 per cent of the variation in literacy proficiency is accounted for in 13 of

² $p(p+1)/2$, where p is the number of variables in the model to be estimated.

Table 1C. Maximum likelihood (standardized) factor loadings for each indicator forming a latent variable

Latent Variable	Indicator	Australia	Belgium	Canada	Chile	Czech Republic	Denmark	Finland	Hungary
ξ_4	X ₄ c11	0.88	0.79	0.98	0.89	0.89	0.74	0.93	0.96
	X ₅ c5	0.70	0.94	0.82	0.85	0.72	0.76	0.77	0.79
	X ₆ iscof	0.57	--	0.49	0.62	0.69	--	0.62	0.77
η_1	Y ₁ edlev	0.90	0.99	0.99	1.00	1.00	0.99	0.89	1.00
	Y ₂ yrsed	0.89	0.92	0.97	0.99	0.91	0.95	0.87	0.95
η_5	Y ₅ e1a	--	--	--	--	0.91	--	--	--
	Y ₆ e1b	--	--	--	--	0.70	--	--	--
	Y ₇ e1c	0.69	0.69	0.79	0.80	--	0.71	0.71	0.81
	Y ₈ e2a	0.81	0.80	0.84	0.86	0.90	0.72	0.70	0.73
	Y ₉ e2c	0.73	0.81	0.73	0.87	--	0.72	0.63	0.56
η_6	Y ₁₁ g1f	1.00	1.00	0.92	0.87	0.69	1.00	0.73	0.81
	Y ₁₂ g9a	--	--	0.77	0.79	0.83	--	0.91	0.83
	Y ₁₃ g8	--	--	0.82	0.58	0.62	--	0.56	0.57
η_7	Y ₁₆ g1a	0.66	0.56	0.75	0.65	0.67	0.71	0.67	0.68
	Y ₁₇ g1d	0.63	0.71	0.70	0.76	0.54	0.53	0.67	0.70
	Y ₁₈ g1g	0.70	0.56	0.69	0.65	0.68	0.75	0.69	0.71
η_{11}	Y ₂₀ doc	1.00	0.98	0.94	0.97	0.97	0.99	1.00	0.94
	Y ₂₁ prose	0.97	0.95	0.93	0.96	0.91	0.94	0.94	0.93
	Y ₂₂ quant	0.97	0.96	0.94	0.98	0.96	0.95	0.95	0.94

Source: International Adult Literacy Survey, 1994-1998.

the country datasets. Canada, Chile, Slovenia and the United States are among the country data sets with the most variance explained, over 60 per cent. The remainder range from 40 to 50 per cent, with the exception of the Czech Republic where only 36 per cent of the variation is explained.

Using a step-wise approach in adding major sets of factors relating to the home background, education, job and other literacy related factors to the initial factors, conveniently reveals the explanatory power of each successive set of factors added to the analysis. The added contributions of each set of factors in terms of explained variance are summarized in Table 3. In a few country datasets, the initial factors, which are age, gender and non-native language status, explain more than 20 per cent of the variation in literacy proficiency.

Table 1C (cont'd). Maximum likelihood (standardized) factor loadings for each indicator forming a latent variable

Ireland	Italy	Netherlands	New Zealand	Norway	Poland	Slovenia	Switzerland	United Kingdom	United States
0.86	0.89	0.81	0.78	0.77	0.95	0.85	0.85	0.88	0.90
0.88	0.87	0.81	0.76	0.77	0.85	0.85	0.84	0.80	0.78
--	0.58	--	--	--	0.67	--	--	--	0.59
1.00	1.00	1.00	0.91	0.94	1.00	1.00	0.94	0.89	1.00
0.90	0.98	0.79	0.75	1.00	0.97	0.98	0.87	0.81	0.96
--	0.80	--	--	--	--	--	--	--	--
--	0.82	--	--	--	--	--	--	--	--
0.80	--	0.66	0.73	0.55	0.86	0.77	0.57	0.69	0.73
0.85	0.65	0.78	0.83	0.84	0.71	0.76	0.79	0.81	0.83
0.84	--	0.70	0.77	0.59	0.56	0.63	0.77	0.78	0.76
1.00	0.85	0.51	0.91	1.00	1.00	0.89	0.78	0.37	0.95
--	0.86	0.71	0.65	--	--	0.70	0.94	--	0.74
--	0.62	0.81	--	--	--	0.73	0.64	0.77	0.83
0.70	0.68	0.70	0.72	0.60	0.73	0.83	0.70	0.70	0.66
0.61	0.68	0.49	0.62	0.58	0.59	0.58	0.62	0.58	0.57
0.76	0.77	0.80	0.69	0.64	0.85	0.77	0.72	0.77	0.62
0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.97	1.00	0.97
0.96	0.95	0.95	0.95	0.94	0.94	0.96	0.95	0.97	0.95
0.97	0.98	0.96	0.96	0.95	0.98	0.97	0.96	0.97	0.96

This is because language status has added explanatory power in countries with relatively high proportions of foreign-born populations, namely Australia, Switzerland and the United States. In the case of Canada and Switzerland, having more than one official language may also explain the relatively strong prediction power of language status.

Although their relative prediction power varies substantially from country to country, home background and education, added in Models 2 and 3, respectively, are also important factors explaining literacy proficiency. While home background explains over an additional 10 per cent in most of the countries, it ranges from as low as 7 per cent in Australia to 29 per cent in Chile. With few exceptions, education explains over an additional 15 per cent of the variation in literacy proficiency, but it too varies substantially, from as low as 7 per cent in Switzerland to 25 per cent in New Zealand.

Table 2. Fit statistics of the structural analysis explaining literacy proficiency

	n	χ^2	df	χ^2/df	RMR	GFI	AGFI	R ²
Australia	6961	6067	171	35.48	0.03	0.93	0.89	0.59
Belgium	1541	1383	174	7.95	0.03	0.93	0.89	0.53
Canada	3307	5382	227	23.71	0.04	0.90	0.84	0.62
Chile	2780	5379	215	25.02	0.03	0.89	0.84	0.60
Czech Republic	2692	2850	245	11.63	0.04	0.93	0.90	0.36
Denmark	2497	2603	165	15.77	0.03	0.93	0.88	0.48
Finland	2373	3082	237	13.00	0.04	0.91	0.87	0.54
Hungary	2067	2943	225	13.08	0.04	0.90	0.86	0.40
Ireland	1854	1589	179	8.88	0.03	0.94	0.90	0.50
Italy	2522	3967	237	16.74	0.03	0.91	0.86	0.54
Netherlands	2512	3189	212	15.04	0.05	0.91	0.86	0.50
New Zealand	3568	2900	185	15.68	0.03	0.94	0.91	0.45
Norway	2656	3503	163	21.49	0.03	0.91	0.84	0.51
Poland	2363	3097	181	17.11	0.03	0.90	0.85	0.42
Slovenia	2335	2573	214	12.02	0.03	0.93	0.89	0.62
Switzerland	3653	3253	201	16.19	0.04	0.93	0.89	0.57
United Kingdom	5799	5159	174	29.65	0.03	0.94	0.89	0.55
United States	2475	2545	236	10.78	0.03	0.93	0.89	0.61

Source: International Adult Literacy Survey, 1994-1998.

Notes:

n - Sample size; df - Degrees of freedom; RMR - Root mean square error; GFI - Goodness of fit index; AGFI - Adjusted goodness of fit index; R² - Coefficient of variation.

In the majority of countries, literacy related factors associated with the job and other contexts such as the home and community, added in Models 4 and 5, respectively, also contribute to an explanation of the variance. While the contribution is substantial in some countries, the added percentage of variation explained is only marginal in many others. In six countries, job related factors explain over an additional 5 per cent of the variation in literacy proficiency. This is also the case for other literacy related factors in three of the countries considered. With the exception of the Czech Republic for job related factors and Hungary as well as Switzerland for other literacy related factors, which do not contribute to the explained variance in literacy proficiency, job and other literacy related factors in the remaining countries each contribute an additional 1 to 5 per cent to explained variance.

Table 3. Step-wise coefficients of variation for models 1-5 by country

	R-squared					Increment to R-square			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 2	Model 3	Model 4	Model 5
Australia	0.23	0.30	0.52	0.57	0.59	0.07	0.22	0.05	0.02
Belgium	0.16	0.24	0.43	0.48	0.53	0.08	0.19	0.05	0.05
Canada	0.19	0.39	0.58	0.59	0.62	0.20	0.19	0.01	0.03
Chile	0.07	0.36	0.57	0.59	0.60	0.29	0.21	0.02	0.01
Czech Republic	0.07	0.15	0.33	0.33	0.36	0.08	0.18	0.00	0.03
Denmark	0.14	0.22	0.41	0.46	0.48	0.08	0.19	0.05	0.02
Finland	0.21	0.31	0.50	0.53	0.54	0.10	0.19	0.03	0.01
Hungary	0.08	0.18	0.39	0.40	0.40	0.10	0.21	0.01	0.00
Ireland	0.06	0.26	0.46	0.48	0.50	0.20	0.20	0.02	0.02
Italy	0.15	0.36	0.50	0.53	0.54	0.21	0.14	0.03	0.01
Netherlands	0.15	0.30	0.43	0.46	0.50	0.15	0.13	0.03	0.04
New Zealand	0.06	0.15	0.40	0.44	0.45	0.09	0.25	0.04	0.01
Norway	0.13	0.25	0.38	0.44	0.51	0.12	0.13	0.06	0.07
Poland	0.09	0.20	0.39	0.41	0.42	0.11	0.19	0.02	0.01
Slovenia	0.18	0.38	0.54	0.61	0.62	0.20	0.16	0.07	0.01
Switzerland	0.37	0.47	0.54	0.57	0.57	0.10	0.07	0.03	0.00
United Kingdom	0.12	0.22	0.43	0.49	0.55	0.10	0.21	0.06	0.06
United States	0.24	0.38	0.56	0.60	0.61	0.14	0.18	0.04	0.01

Source: International Adult Literacy Survey, 1994-1998.

Notes:

Model 1 includes age, gender and non-native language status; Model 2 adds home background; Model 3 adds education; Model 4 adds job-related factors; Model 5 adds other literacy related factors.

8.2 Direct and total effects

All parameter estimates are reported in Tables 4 and 5. The estimates are standardized maximum likelihood regression weights, which enable comparisons to be made both within and among country models. Each regression weight, for example (0.10), may be interpreted as a 0.10 (or 10%) change of a standard deviation in the dependent factor for every one standard deviation change in the independent factor considered.

Table 4. Direct and total effects of all factors on literacy proficiency, standardized maximum likelihood regression weights, population aged 25-65

	Australia	Belgium	Canada	Chile	Czech Republic	Denmark	Finland	Hungary
A. Direct effects of factors on literacy proficiency								
Gender	--	--	-0.06	--	0.07	0.13	--	--
Age	-0.11	-0.17	-0.13	--	-0.11	-0.23	-0.15	-0.15
Language status	-0.33	-0.17	-0.22	--	-0.04	-0.07	-0.14	--
Home background	0.03	-0.09	0.13	0.09	0.07	0.10	0.10	0.08
Education	0.30	0.30	0.39	0.51	0.44	0.26	0.42	0.44
Job	0.34	0.24	0.22	0.11	-0.03	0.35	0.21	0.05
Labour force participation	0.14	0.07	0.05	--	--	0.09	0.08	--
Occupational status	0.07	0.08	0.06	--	-0.08	0.12	-0.06	--
Literacy practice at work	0.13	0.09	0.11	0.11	--	0.14	0.19	--
Job-related training	--	--	--	--	0.05	--	--	0.05
Other	0.24	0.20	0.20	0.19	0.11	0.15	0.13	0.04
Other^a - Except TV	0.24	0.32	0.20	0.19	0.17	0.19	0.13	0.12
Reading currents events	0.04	0.06	0.11	0.15	--	--	0.08	0.12
Literacy practice at home	0.14	0.19	--	--	0.17	0.13	0.05	--
Personal-interest related Adult education	--	--	--	0.04	--	--	--	--
Community participation	0.06	0.07	0.08	--	--	0.06	--	--
Television	--	-0.12	--	--	-0.06	-0.04	--	-0.08
B. Total effect of factors on literacy proficiency								
Gender	0.04	0.08	-0.07	--	0.09	0.14	-0.03	0.02
Age	-0.15	-0.20	-0.17	-0.13	-0.12	-0.22	-0.27	-0.13
Language status	-0.35	-0.16	-0.29	--	-0.04	-0.07	-0.19	--
Home Background	0.28	0.32	0.49	0.56	0.33	0.31	0.36	0.38
Education	0.54	0.59	0.55	0.67	0.48	0.49	0.54	0.51
Job	0.41	0.31	0.24	0.16	--	0.41	0.33	0.11
Labour force participation	0.13	0.08	0.05	0.02	0.01	0.08	0.08	0.04
Occupational status	0.15	0.14	0.08	0.03	-0.06	0.19	0.06	0.02
Literacy practice at work	0.13	0.09	0.11	0.11	--	0.14	0.19	--
Job-related training	--	--	--	--	0.05	--	--	0.05
Other^b	0.24	0.20	0.20	0.19	0.11	0.15	0.13	0.04
Other^{a,b} - Except TV	0.24	0.32	0.20	0.19	0.17	0.19	0.13	0.12

Source: International Adult Literacy Survey, 1994-1998.

Notes:

-- indicates $p > 0.05$, not statistically significant.

Table 4 (cont'd). Direct and total effects of all factors on literacy proficiency, standardized maximum likelihood regression weights, population 25-65

Ireland	Italy	Netherlands	New Zealand	Norway	Poland	Slovenia	Switzerland	United Kingdom	United States
0.07	0.04	--	--	0.08	0.10	-0.05	--	0.07	--
-0.07	-0.09	-0.22	-0.08	-0.25	-0.13	-0.22	-0.10	-0.13	--
--	-0.06	-0.16	-0.17	-0.18	--	--	-0.44	-0.21	-0.34
0.06	0.14	0.08	0.05	0.12	0.05	0.09	0.11	0.06	0.11
0.47	0.48	0.26	0.43	0.20	0.34	0.17	0.18	0.19	0.29
0.13	-0.03	0.26	0.26	0.30	0.18	0.61	0.24	0.37	0.28
--	--	0.12	0.08	0.09	0.08	0.14	--	0.15	0.08
--	-0.12	0.07	0.10	0.17	--	--	0.13	0.16	0.09
0.13	0.09	0.07	0.11	--	0.14	0.47	0.11	0.04	0.11
--	--	--	-0.03	0.04	-0.04	--	--	0.02	--
0.23	0.22	0.27	0.09	0.36	0.19	--	0.04	0.40	0.16
0.23	0.22	0.31	0.12	0.43	0.15	0.00	0.07	0.40	0.20
0.13	0.16	0.18	0.12	0.25	--	--	--	0.14	0.07
--	--	0.07	--	0.15	0.15	--	0.05	0.21	0.09
--	--	--	--	--	--	--	-0.03	0.02	--
0.10	0.06	0.06	--	0.03	--	--	0.05	0.03	0.04
--	--	-0.04	-0.03	-0.07	0.04	--	-0.03	--	-0.04
0.07	0.13	0.10	0.02	0.06	0.05	-0.03	0.06	0.10	-0.02
-0.12	-0.15	-0.20	-0.03	-0.20	-0.16	-0.26	-0.09	-0.15	0.04
-0.01	-0.03	-0.17	-0.13	-0.16	--	-0.02	-0.48	-0.22	-0.41
0.46	0.50	0.40	0.35	0.38	0.36	0.49	0.34	0.33	0.41
0.58	0.54	0.47	0.58	0.40	0.53	0.52	0.36	0.54	0.53
0.21	0.03	0.31	0.33	0.38	0.23	0.66	0.25	0.42	0.33
0.02	0.03	0.11	0.10	0.14	0.07	0.07	-0.02	0.15	0.08
0.06	-0.09	0.13	0.15	0.20	0.06	0.12	0.16	0.21	0.14
0.13	0.09	0.07	0.11	--	0.14	0.47	0.11	0.04	0.11
--	--	--	-0.03	0.04	-0.04	--	--	0.02	--
0.23	0.22	0.27	0.09	0.36	0.19	--	0.04	0.40	0.16
0.23	0.22	0.31	0.12	0.43	0.15	0.00	0.07	0.40	0.20

Notes (cont'd):

- a. Watching television is separated because it is expected to have a negative effect on literacy proficiency and would thus have confounding effects on analyses grouping the results for the set of factors referred to as 'other';
b. Total and direct effects are identical for other literacy related factors because there are no intermediate variables between the set of factors referred to as 'other' and literacy proficiency.

Table 5. Direct effects of home background, education, labour force participation and occupational status on various intermediate factors, standardized maximum likelihood regression weights, population aged 25-65

	Czech							
	Australia	Belgium	Canada	Chile	Republic	Denmark	Finland	Hungary
A. Direct effects of home background on intermediate factors								
Education	0.44	0.63	0.62	0.66	0.52	0.40	0.46	0.55
Labour force participation	--	--	-0.08	--	--	-0.14	-0.09	--
Occupational status	-0.03	--	0.04	0.16	--	0.08	--	0.09
Literacy practice at work	--	--	--	--	--	-0.07	--	0.10
Job-related training	--	--	0.09	--	--	--	--	--
Read/follow current events	--	--	0.08	0.17	--	--	0.13	0.13
Literacy practice at home	0.11	0.16	0.25	0.11	0.08	0.11	0.14	0.23
Personal-interest related adult ed.	--	--	--	--	0.06	--	0.06	--
Community participation	--	--	0.08	-0.11	--	--	--	--
Television	--	--	-0.15	0.09	-0.05	-0.08	--	--
B. Direct effects of education on intermediate factors								
Labour force participation	0.20	0.19	0.28	0.19	0.09	0.23	0.16	0.26
Occupational status	0.63	0.55	0.63	0.55	0.78	0.62	0.79	0.78
Literacy practice at work	0.23	0.46	0.40	0.48	0.35	0.28	0.15	0.38
Job-related training	0.16	0.20	0.13	0.13	0.14	0.14	0.19	--
Read/follow current events	0.21	0.14	0.35	0.54	0.29	0.13	0.15	0.48
Literacy practice at home	0.49	0.49	0.40	0.49	0.36	0.34	0.48	0.28
Personal-interest related adult ed.	0.13	0.17	0.05	0.08	--	0.04	0.16	0.12
Community participation	0.21	0.26	0.28	0.18	0.18	0.11	0.25	0.17
Television	--	-0.33	-0.21	0.09	-0.24	-0.12	-0.31	0.17
C. Direct effects of labour force participation on intermediate factors								
Occupational status	-0.03	--	--	--	--	-0.05	-0.09	-0.24
Literacy practice at work	--	--	-0.05	0.12	--	0.05	--	--
Job-related training	0.19	0.13	0.15	0.12	0.19	0.14	0.17	0.20
Read/follow current events						0.09		
Literacy practice at home	0.13	--	0.01	0.06	0.09		0.12	0.10
Personal-interest related adult ed.	-0.05	--	-0.12	--	-0.07	-0.12	-0.07	0.11
Community participation	-0.03	-0.06	-0.04	--	--	-0.06	0.09	0.12
Television	-0.03	-0.07	0.07	--	0.05	--	--	0.20
Watching Television	-0.03	-0.09	-0.13	-0.12	-0.12	-0.16	-0.13	-0.30
D. Direct effects of occupational status on intermediate factors								
Literacy practice at work		0.33	0.23	0.34	0.24	0.36	0.59	0.38
Job-related training	0.18	0.14	0.15	0.29	0.07		0.18	0.26
Read/follow current events	--	0.15	--	-0.05		--	0.16	-0.11
Literacy practice at home	0.05	0.10	--	0.10	0.12	0.10	--	0.26
Personal-interest related adult ed.	--	--	--	0.05	0.16	--	--	0.12
Community participation	--	--	-0.07	--	-0.07	--	-0.09	0.14
Television		--	0.05	-0.17	--	-0.14	--	-0.32

Source: International Adult Literacy Survey, 1994-1998.

Table 5 (cont'd). Direct effects of home background, education, labour force participation and occupational status on various intermediate factors, standardized maximum likelihood regression weights, population aged 25-65

Ireland	Italy	Netherlands	New Zealand	Norway	Poland	Slovenia	Switzerland	United Kingdom	United States
0.59	0.64	0.61	0.53	0.44	0.54	0.60	0.61	0.44	0.60
--	-0.13	--	-0.09	-0.06	--	-0.07	--	-0.05	-0.12
0.06	--	--	--	0.17	--	0.08	--	0.03	--
0.13	0.09	--	--	0.08	--	0.15	0.13	--	-0.11
--	--	--	--	0.10	--	--	--	0.04	--
0.29	0.15	0.16	--	0.11	0.13	0.17	0.17	0.11	--
0.19	0.11	0.09	0.09	0.11	0.11	0.19	0.15	0.08	0.06
--	--	--	--	--	--	--	--	0.13	--
0.07	--	--	-0.06	0.07	-0.11	--	-0.10	0.08	--
-0.12	-0.10	-0.10	-0.11	-0.12	0.05	--	--	-0.09	--
0.20	0.31	0.15	0.19	0.21	0.14	0.18	0.07	0.23	0.26
0.67	0.90	0.63	0.56	0.57	0.75	0.75	0.58	0.66	0.63
0.23	0.31	0.28	0.17	0.09	0.50	0.53	0.39	0.19	0.43
--	--	0.14	0.12	0.08	0.09	0.20	0.19	0.16	0.22
0.13	0.48	0.31	0.21	--	0.40	0.44	0.16	0.44	0.42
0.36	0.76	0.35	0.39	0.29	0.47	0.36	0.43	0.46	0.40
0.08	0.23	0.11	--	0.07	0.17	--	0.12	0.09	0.11
0.16	0.34	0.08	0.18	--	0.32	0.10	0.21	0.22	0.21
--	-0.11	-0.22	-0.13	-0.16	--	-0.14	-0.29	-0.07	-0.09
--	-0.21	--	0.04	--	--	-0.17	-0.05	-0.09	-0.08
0.05	--	--	0.06	--	0.38	-0.10	-0.04	-0.07	--
0.14	0.24	0.18	0.18	0.21	0.19	0.16	0.19	0.27	0.23
0.08	0.06	--	0.07	0.15	--	--	--	0.11	0.07
-0.09	-0.08	-0.09	-0.12	-0.08	0.14	--	-0.11	--	--
--	-0.18	--	-0.05	-0.06	0.06	--	-0.04	--	--
--	--	-0.13	-0.10	0.07	--	--	-0.08	--	--
-0.09	-0.19	-0.13	-0.08	-0.14	-0.19	0.20	-0.13	-0.18	-0.17
0.40	0.40	0.44	0.47	0.60	0.38	0.26	0.14	0.52	0.26
0.28	0.35	0.07	0.23	0.13	0.19	0.22	0.10	0.18	0.19
--	--	0.07	--	--	--	-0.08	0.05	--	--
0.19	-0.08	0.12	0.12	0.15	0.14	0.18	0.22	0.12	0.17
0.11	-0.09	--	0.07	--	0.06	0.26	0.05	--	--
0.06	--	0.08	0.06	0.10	--	--	0.05	0.06	0.10
-0.22	-0.09	-0.15	-0.10	-0.06	-0.19	0.28	-0.04	-0.20	-0.12

Notes:

-- indicates $p > 0.05$, not statistically significant.

Table 6. Summary of total, direct and indirect effects of home background, education, the job and other activities on literacy proficiency, standardized maximum likelihood regression weights, population aged 25-65

	Australia	Belgium	Canada	Chile	Czech Republic	Denmark	Finland	Hungary
Home Background								
Total effect	0.28	0.32	0.49	0.56	0.33	0.31	0.36	0.38
Direct effect	0.03	-0.09	0.13	0.09	0.07	0.10	0.10	0.08
Indirect effect	0.25	0.41	0.36	0.47	0.26	0.21	0.26	0.30
Education	0.236	0.372	0.341	0.441	0.249	0.196	0.252	0.283
Job	-0.004	--	-0.001	0.005	--	-0.006	-0.008	0.002
Other	0.015	0.030	0.015	0.026	0.017	0.018	0.017	0.016
Education								
Total effect	0.54	0.59	0.55	0.67	0.48	0.49	0.54	0.51
Direct effect	0.30	0.30	0.39	0.51	0.44	0.26	0.42	0.44
Indirect effect	0.24	0.29	0.17	0.16	0.04	0.23	0.12	0.07
Job	0.146	0.132	0.106	0.075	-0.036	0.175	0.093	0.034
Other	0.090	0.159	0.063	0.084	0.076	0.056	0.036	0.044
Job								
Total effect	0.41	0.31	0.24	0.16	--	0.41	0.33	0.11
Direct effect	0.34	0.24	0.22	0.11	-0.03	0.35	0.21	0.05
Indirect effect	0.07	0.07	0.02	0.05	0.03	0.06	0.12	0.06
Other	0.070	0.070	0.020	0.050	0.030	0.060	0.120	0.060
Other^a								
Total effect	0.24	0.32	0.20	0.19	0.17	0.19	0.13	0.12
Direct effect	0.24	0.32	0.20	0.19	0.17	0.19	0.13	0.12
Watching television ^b	--	-0.12	--	--	-0.06	-0.04	--	-0.08

Source: International Adult Literacy Survey, 1994-1998.

Notes:

-- indicates $p > 0.05$, not statistically significant.

Comparisons between countries must be done with care since the variables are standardized by country. Therefore, comparisons are relative to the mean and standard deviation of the distributions in each country. So, a one standard deviation increase in one country is not necessarily identical to a one standard deviation increase of the same variable in another country. Regardless, it is convenient to think in relative terms within countries rather than absolute terms across countries.

Direct effects involve the direct relationship between factors, whereas total effects account for both the direct relationship as well as all indirect relationships

Table 6 (cont'd). Summary of total, direct and indirect effects of home background, education, the job and other activities on literacy proficiency, standardized maximum likelihood regression weights, population aged 25-65

Ireland	Italy	Netherlands	New Zealand	Norway	Poland	Slovenia	Switzerland	United Kingdom	United States
0.46	0.50	0.40	0.35	0.38	0.36	0.49	0.34	0.33	0.41
0.06	0.14	0.08	0.05	0.12	0.05	0.09	0.11	0.06	0.11
0.40	0.36	0.32	0.30	0.26	0.31	0.40	0.23	0.27	0.30
0.339	0.344	0.289	0.305	0.177	0.292	0.314	0.214	0.238	0.315
0.020	0.004	--	-0.009	0.031	--	0.074	0.014	-0.001	-0.022
0.045	0.024	0.039	0.003	0.055	0.019	--	0.003	0.037	0.005
0.58	0.54	0.47	0.58	0.40	0.53	0.52	0.36	0.54	0.53
0.47	0.48	0.26	0.43	0.20	0.34	0.17	0.18	0.19	0.29
0.11	0.06	0.21	0.15	0.20	0.19	0.35	0.18	0.35	0.24
0.072	-0.039	0.120	0.117	0.149	0.136	0.354	0.133	0.184	0.159
0.033	0.097	0.094	0.029	0.055	0.071	--	0.037	0.167	0.077
0.21	0.03	0.31	0.33	0.38	0.23	0.66	0.25	0.42	0.33
0.13	-0.03	0.26	0.26	0.30	0.18	0.61	0.24	0.37	0.28
0.08	0.06	0.05	0.07	0.08	0.05	0.05	0.01	0.05	0.05
0.080	0.060	0.050	0.070	0.080	0.050	0.050	0.010	0.050	0.050
0.23	0.22	0.31	0.12	0.43	0.15	--	0.07	0.40	0.20
0.23	0.22	0.31	0.12	0.43	0.15	--	0.07	0.40	0.20
--	--	-0.04	-0.03	-0.07	0.04	--	-0.03	--	-0.04

Notes (cont'd):

a. Total and direct effects are identical because there are no intermediate variables between the set referred to as 'other' factors and literacy proficiency. As a result there are no indirect effects.

b. Watching television is separated because it is expected to have a negative effect on literacy proficiency and would thus have confounding effects on the remainder of the analysis.

arising through other intermediate factors. The indirect effect associated with each factor can be computed by taking the difference between the total and direct effects. Table 4 reports all direct and total effects associated with the relationship between each of the factors and literacy proficiency, whereas Table 5 reports direct effects associated with the relationship between select factors.

The focus of the analysis is on major sets of factors labelled as 'home background', 'education', 'job' and 'other' literacy related factors. For this reason,

Table 7. Substitution and complementary effects among home background, education, job and other factors in predicting literacy proficiency, population aged 25-65

	Australia	Belgium	Canada	Chile	Czech Republic	Denmark	Finland	Hungary
Substitution (Direct) effects								
Home background	0.03	-0.09	0.13	0.09	0.07	0.10	0.10	0.08
Education	0.30	0.30	0.39	0.51	0.44	0.26	0.42	0.44
Job	0.34	0.24	0.22	0.11	-0.03	0.35	0.21	0.05
Other ^a	0.24	0.32	0.20	0.19	0.17	0.19	0.13	0.12
Complementary (Indirect) effects								
Education (--> hbg)	0.24	0.37	0.34	0.44	0.25	0.20	0.25	0.28
Job (--> hbg)	0.00	- -	0.00	0.01	- -	-0.01	-0.01	0.00
Job (--> ed)	0.15	0.13	0.11	0.07	-0.04	0.18	0.09	0.03
Other ^a (--> hbg)	0.02	0.03	0.01	0.03	0.02	0.02	0.02	0.02
Other ^a (--> ed)	0.09	0.16	0.06	0.08	0.08	0.06	0.04	0.04
Other ^a (--> job)	0.07	0.07	0.02	0.05	0.03	0.06	0.12	0.06
Net complementary (Indirect) effects								
Education (--> hbg)	0.24	0.37	0.34	0.44	0.25	0.20	0.25	0.28
Job (--> hbg & ed)	0.14	0.13	0.11	0.08	-0.04	0.17	0.08	0.04
Other ^a (--> hbg & ed & job)	0.18	0.26	0.10	0.16	0.12	0.13	0.17	0.12

Source: International Adult Literacy Survey, 1994-1998.

Notes:

- - indicates $p > 0.05$, not statistically significant.

Table 6 reports the estimates associated with job and other literacy related factors in summary form. In the case of other literacy related factors, television is excluded from the summary estimate because it is expected to have a confounding effect. The frequency of watching television is expected to have a negative relationship with literacy proficiency whereas all the other literacy related factors are expected to have a positive relationship. Table 6 also reports the indirect effect of each major factor on literacy proficiency. Furthermore, the indirect effect is summarized by each set of intermediate factors, demonstrating their relative importance in the overall relationship.

Table 7 (cont'd). Substitution and complementary effects among home background, education, job and other factors in predicting literacy proficiency, population aged 25-65

Ireland	Italy	Netherlands	New Zealand	Norway	Poland	Slovenia	Switzerland	United Kingdom	United States
0.06	0.14	0.08	0.05	0.12	0.05	0.09	0.11	0.06	0.11
0.47	0.48	0.26	0.43	0.20	0.34	0.17	0.18	0.19	0.29
0.13	-0.03	0.26	0.26	0.30	0.18	0.61	0.24	0.37	0.28
0.23	0.22	0.31	0.12	0.43	0.15	- -	0.07	0.40	0.20
0.34	0.34	0.29	0.31	0.18	0.29	0.31	0.21	0.24	0.32
0.02	0.00	- -	-0.01	0.03	- -	0.07	0.01	0.00	-0.02
0.07	-0.04	0.12	0.12	0.15	0.14	0.35	0.13	0.18	0.16
0.04	0.02	0.04	0.00	0.05	0.02	- -	0.00	0.04	0.01
0.03	0.10	0.09	0.03	0.05	0.07	- -	0.04	0.17	0.08
0.08	0.06	0.05	0.07	0.08	0.05	0.05	0.01	0.05	0.05
0.34	0.34	0.29	0.31	0.18	0.29	0.31	0.21	0.24	0.32
0.09	-0.04	0.12	0.11	0.18	0.14	0.43	0.15	0.18	0.14
0.16	0.18	0.18	0.10	0.19	0.14	0.05	0.05	0.25	0.13

Notes (cont'd):

a. Note that watching television is excluded from this analysis because it is expected to have a negative effect on literacy proficiency and would thus have confounding effects.

8.3 Substitution and complementary effects

Direct and indirect effects may be loosely interpreted as substitution and complementary effects, respectively. In so doing, however, it is important to recognize the limitations of such an interpretation. Measures indicating learning and other behaviours in adulthood, as represented by the job and other literacy related factors considered, only reflect one period. The patterns of participation in such activities are assumed to recur throughout adulthood. Using data from a Swedish longitudinal study, Tuijnman (1991) finds evidence of such continuity among Swedish men. Because the IALS is cross sectional study, it is not possible to take into account the possible cumulative effects of adult learning.

The following example illustrates the interpretation of substitution and complementary effects in terms of direct and indirect effects within the structural model analyzed. Both the home background and education are hypothesized to influence literacy proficiency but home background is also hypothesized to influence the amount of education completed by an individual. Assuming both factors exert a positive influence, their direct effects on literacy proficiency, which are independent of each other, may be interpreted as substitutes to each other as well as to all other factors considered. At the same time, the effect of home background on education will serve to complement the overall effect of home background on literacy proficiency because education will in turn affect literacy proficiency.

8.4 Language status, age and gender

As mentioned the focus of the analysis is on the major sets of factors labelled home background, education, job and other literacy related factors. Language status, age and gender are included in the analysis as control variables because previous research suggests that they are significant factors. The findings associated with these factors are more or less consistent with previous research and theory. The following briefly discusses the results associated these factors.

Having a mother tongue different than the language of the literacy assessment has a strong negative effect in most countries, especially in countries with large foreign-born populations or with more than one official language. Results in Table 4A suggests that the effect is insignificant in most countries with small or negligible foreign-born populations, which have a different mother tongue, such as Chile, Hungary, Ireland, Poland and Slovenia. Independent of all other variables, age has a negative influence on literacy proficiency in all countries except Chile and the United States. As expected, gender does not have a significant direct effect on literacy proficiency in most countries.

8.5 Home background

Home background is measured as a latent construct using the father and mother's level of educational attainment as well as the father's occupational status in many cases. On a standardized basis, one standard deviation above the mean of the latent construct is for interpretative purposes considered to reflect a favourable home background, whereas the mean reflects an average home background and one standard deviation below reflects a relatively unfavourable home background.

Independent of all other factors, a favourable home background, is associated with an observed literacy proficiency that ranges from 3 per cent (Australia) to 14 per cent (Italy) above each respective country mean³ (see Table 4). These effects are interpreted as substitution effects since they occur independent of any other factor included in the analysis. But relative to other major factors, home background has the weakest substitution effect in 13 out of the 18 countries considered. This suggests that there may exist opportunities to compensate for an unfavourable home background, such as education and engagement in other literacy related situations.

Home background interacts strongly with education, however. Those who come from a favourable home background also tend to complete higher levels of education (see Table 5A). Thus it will have a strong indirect effect on literacy via its influence on education, since the latter exerts a strong influence on literacy proficiency (discussed in next section). As reported in Table 7, having attended some kind of post-secondary schooling (i.e., a one standard deviation above the mean level of education) complements the effect of a favourable home background by as low as 20 per cent in Denmark to as high as 44 per cent in Chile.

8.6 Education

Education is measured as a latent construct by combining two indicators, namely years of schooling completed and the highest level of education attained. The average mean of the latent constructs correspond to approximately 11 to 12 years of schooling (see Table 1B), which approximately reflects the completion of secondary schooling in most advanced industrialized countries. The average standard deviation is approximately 3 to 4 years of schooling. Therefore, a one standard deviation increase in education approximately reflects some kind of tertiary level education, whereas a standard deviation below the mean approximately reflects those that completed less than secondary.

Without exception, education is the strongest single factor explaining literacy proficiency. Independent of other factors, some kind of tertiary education is associated with an observed literacy proficiency ranging from 17

³ A negative estimate for Belgium is considered an interesting anomaly because it suggests that if a favourable home background is not followed up with education or other positive influences, it will be associated with an observed literacy proficiency that is 9 per cent below the country mean. It should be noted that the Belgium sample only includes the Flemish community and the capital city, Brussels, is excluded from the sample. This calls the validity and generalizability of the results into question for this country.

per cent (Slovenia) to 51 per cent (Chile) over the respective country mean (see Table 4A). Conversely, attaining less than secondary schooling is associated with an observed literacy proficiency ranging from 17 to 51 per cent below the respective country mean (i.e., a one standard deviation below the mean level of education, which is less than secondary attainment, corresponds to a range of 17 to 51 per cent of a standard deviation below the mean literacy proficiency depending on the country). Therefore, while education is a strong complement to home background, it is also the most significant substitute of any other single factor.

When taken together, summary estimates of direct effects for the sets of factors referred to as ‘job’ and ‘other’ literacy related factors add up to be stronger than the total effect of education in Australia, Denmark, the Netherlands, Norway, Slovenia, and the United Kingdom (see Table 6). This demonstrates the potential role of the job and other literacy related factors in influencing literacy proficiency. That is, they may be good substitutes for those who complete relatively less education and/or come from an unfavourable home background. While job and other literacy related factors demonstrate their potential to substitute for education, however, results in Table 7 suggest that in most countries they also complement education. Some tertiary education (i.e., a one standard deviation of education above the country mean) may substantially influence the nature of the job in terms of its literacy enhancing effect as well as other literacy related behaviours in daily life. See the estimates of direct effects of education on job and other literacy related factors in Table 5B.

8.7 *Job*

The ‘job’ includes a set of factors, namely labour force participation, occupational status, literacy practice at work and participation in job-related training. Labour force is measured as a dichotomous variable, where one indicates participation in the labour force, and includes both employed and unemployed individuals. While it indicates the opportunity to benefit from the nature of the work environment in terms of enhancing or maintaining literacy proficiency, it primarily acts as a missing value indicator in the model. In contrast, the remaining factors scale the nature of the work environment.

Occupational status is scaled by ordering a one-digit Standardized Occupational Classification (SOC) variable, in the same way for each country, according to an increasing scale reflecting the likelihood of benefiting from a literacy rich work environment. One standard deviation above the mean occupational status is assumed to reflect a relatively literacy rich work environment. To supplement this, literacy practice at work is measured as a

latent construct using three out of the same five indicators available for each country (see Table 1C). One standard deviation above the mean reflects more intense literacy engagement at work. Finally, job-related training is measured as a dichotomous variable, where one indicates participation in job-related training in the 12 months preceding the interview.

For convenience, the results of each factor associated with the work environment are considered collectively. While they are not standardized or scaled on the same basis, it is convenient for discussion and interpretative purposes to lump the variables together under the title ‘job’, and to consider a collective standard deviation above the mean as a reflection of a relatively nurturing work environment, or conversely, a standard deviation below the mean as a reflection of an unfavourable work environment in terms of developing and maintaining literacy proficiency.

With the exception of a few countries, the nature of the work environment can substantially explain or predict literacy proficiency. Excluding the Czech Republic, Hungary and Italy, a nurturing work environment is associated with an observed literacy proficiency ranging from 11 (Chile) to 61 (Slovenia) per cent over the respective country mean (see Table 4A). Conversely, an unfavourable working environment is associated with an observed literacy proficiency of 11 to 61 per cent less than the respective country mean. In two of the excluded countries, namely, the Czech Republic and Italy, the reverse occurs – albeit at a negligible magnitude of 3 per cent – casting doubt on the reliability of the scale constructed to reflect the nature of the work environment in terms of literacy proficiency in those countries. General differences in work cultures as well as substantial variations in the occupational and production structures of those countries in term of typical work tasks may explain the perverse effects. Otherwise, the results are as expected and relatively consistent, which lends some credibility to the latent constructs.

As it is constructed, the nature of the work environment appears to be an important predictor of literacy proficiency. In a few countries, such as Australia, Denmark and Switzerland, but particularly in Slovenia, the nature of the work environment is the strongest predictor of literacy proficiency (see Table 6). Furthermore, the nature of the work environment can also be an important complement to education. Excluding the Czech Republic, Hungary and Italy, this complementary effect can range from as low as 7 per cent in Chile and Ireland to 35 per cent in Slovenia (see Table 7).

8.8 *Other*

The set of factors referred to as ‘other’ literacy related factors includes reading current events, literacy practice at home, participation in adult education for non-job related reasons, and participation in community or volunteer organizations. Watching television is excluded from the summary estimate since it is expected to be negatively associated with literacy proficiency. Indeed, the results reported in Table 4A indicate that watching television is negatively associated with literacy proficiency in half of the countries considered. While there is no relationship in most of the other countries, the effect is positive for Poland. Combining the latter result with Table 5A, in which Chile and Poland are the only countries where home background and television watching are positively related, suggests that TV watching in Poland may be related to socio-economic status, and thus exert a positive effect on literacy proficiency via this proxy relation.

The remaining variables within the category ‘other’ are reported as a summary estimate in Table 6. Reading current events is measured as a latent construct, which is interpreted as the intensity of following current events via printed sources such as newspapers and magazines. Similarly, literacy practice at home is measured as a latent construct that is interpreted to reflect the extent of engagement in other literacy related activities within the home and leisure contexts. The latter includes indicators measuring the frequency of visiting the library, reading books and writing letters in daily life, but outside the work environment. Personal interest related adult education is measured as a dichotomous variable, where one indicates participation in the 12 months preceding the interview. Finally, an indicator measuring the frequency of participating in community activities captures the potentially nurturing environment of the community context in terms of literacy related situations.

For convenience, a collective one standard deviation above each respective mean of the factors included within the category ‘other’, is interpreted as a reflection of good literacy related habits in daily life. While each individual factor can be marginal and can also vary substantially from country to country (see Table 4A), together they consistently generate a significant and positive relation with literacy proficiency. This occurs above and beyond educational and home backgrounds as well as the potentially nurturing environment of the work place. Only in Slovenia is the collective effect of ‘other’ insignificant.

Excluding Slovenia, results in Table 6 suggest that good literacy related habits in daily life is associated with as low as a 7 per cent of a standard deviation over the country mean in Switzerland to as high as 43 per cent in Norway. These results suggest that literacy related habits in daily life could

substantially substitute or compensate for low levels of education and an unfavourable home background as well as an unfavourable literacy environment at work.

While this may be the case, good literacy related habits in daily life also appear to complement education and home background as well as the job. With few exceptions, the estimates reported in Table 6 show that literacy related activities in daily life interact positively with these other factors in terms of affecting literacy proficiency. In Belgium and the United Kingdom, the net complementary effect of good literacy related habits in daily life accounts for as much as 25 per cent of a standard deviation above the mean literacy proficiency in those countries.

9. Discussion of results

9.1 General patterns

The question is posed whether general relationships among factors predicting literacy proficiency can be generalized across countries. By replicating the procedure of fitting 18 country data sets, which are comparable, to the same general structure hypothesized to underlay adult literacy proficiency, this study aimed to identify general patterns predicting literacy proficiency. In general, while the individual pathways are found to substantially differ among the 18 models, the data is deemed to fit the same general structure relatively well. This permits a comparative analysis among the 18 countries considered, in terms of the relative significance and magnitude of each of the pathways posited in the general model. It also permits the observation that the general relationships implied by the model may indeed be a reasonable depiction of the underlying processes affecting adult literacy proficiency. The following summarizes some of the general relationships that are observed from the results of the analysis.

One pattern that consistently emerges is that education is the strongest single factor affecting literacy proficiency, which is independent from any other factor including home background. This suggests that education may be a powerful substitute for a favourable home background as well as any other factor. Although not as strong as education, home background is also found to be a consistently positive factor affecting adult literacy proficiency. This implies that the home environment alone plays an important role in the development of literacy skills. But findings suggest that it exerts its strongest influence on literacy by encouraging and supporting individuals to acquire an education. This is evidenced by the strong effect of the home background on educational

attainment. On average, having three to four years more than secondary education and coming from a favourable home background implies a proficiency that is 49 (Switzerland) to 79 (Chile) per cent of a standard deviation above the mean, depending on the country considered (see Table 6)⁴.

It should be noted that in this analysis, the home background variable is defined primarily on the basis of the parents' level of education. Therefore, the complementary effect between home background and education may be interpreted as a cumulative effect of education between successive generations. This amplifies the significance of education over time.

Other patterns that emerge involve the 'job' and 'other' literacy related factors, which are also found to be important sets of factors affecting literacy proficiency. Individually, the factors can be marginal and vary substantially from country to country, but by reporting the results in a collective fashion under the categories 'job' and 'other', the effects are found to be fairly consistent and substantial for most of the countries considered.

Working in a literacy rich environment implies a proficiency that is 5 (Hungary) to 61 (Slovenia) per cent of a standard deviation above the mean, depending on the country (see Table 6). The Czech Republic and Italy are exceptions, because the manner in which a literacy rich environment is constructed results in a negative relationship. This kind of result demonstrates the difficulty of constructing complex variables that are reliable and comparable, even though the indicators used to formulate the constructs are deemed comparable. The findings are presumably the result of differences in work cultures. Indeed, Table 4A reveals that the negative effect arises primarily through the manner in which the occupational status variable was constructed.

In some countries, having good literacy related habits in daily life can also imply higher literacy proficiency, ranging from 7 (Switzerland) to 43 (Norway) per cent above the mean, depending on the country considered (see Table 6). An important finding suggests that in some countries combining the effect of the 'job' and 'other' can imply an influence on literacy proficiency that is stronger than education. This means that the type of work and daily literacy related habits of an adult, can serve to substitute or compensate for a low level of education. On the other hand, there is a clear pattern showing that those with more education also engage in literacy related situations at work, at home and in the community more often.

⁴ This result is calculated by adding the total effect of the home background that is net of the direct effect on education with the total effect of education on literacy proficiency.

Finally, the findings imply that a lack of engagement in literacy related situations at work, at home or in the community could offset the positive influence of education and the home background. This suggests that education alone may not be able to sustain adult literacy. Moreover, there may be substitutes to developing and sustaining literacy that are pervasive.

9.2 *Implications*

Interpreting the results in terms of practice engagement theory, indeed suggests that those who engage more frequently in literacy related situations, which arise in variety of contexts, are more proficient in literacy. In other words, the view that literacy skills are continually acquired and developed throughout the cycle of lifelong and lifewide learning is supported. Those experiencing and practicing literacy in a variety of contexts reach higher levels of functionality.

The *Unified Perspective* adopted in this article reconciles the dichotomous approach to viewing the specificity and generality of literacy. By interpreting the IALS literacy proficiency measures the way they were intended allows one to use the information provided to extract meaningful interpretations of how literacy practice in a particular context can contribute to functional literacy. This does not change the fact, however, that a select team of scientists and stakeholders pinpointed the typical literacy related situations that individuals are expected to encounter, and therefore expected to function in.

In terms of policy and practice, initial formal education appears to be at the centre of the process underlying the development and sustenance of adult literacy proficiency. It interacts strongly with all of the other factors considered including the home background and the extent of engagement and involvement in literacy related activities throughout the lifespan. As such, supporting the development and widening of access to education systems would thus seem to be the key to developing the skill profile of country populations over the long term.

Because education has a strong substitution effect, providing wide access and support in a universal sense can strongly compensate for those from relatively disadvantaged home backgrounds. Moreover, the apparent cumulative effect of education between successive generations would serve to reinforce and amplify the development of literacy over time. Furthermore, the results indicate that education is part of an interdependent process of literacy development. As such, understanding and successfully harnessing the positive interactions among the key factors can enhance the effect of education on literacy.

It is important to consider the interaction of education and literacy related behaviours in the work, home, leisure and community contexts that may occur

throughout life. Although pervasive, education is only one context. From a pedagogical point of view, the teaching-learning process occurring in the classroom must ensure that the knowledge and skills learned are relevant or transferable to other contexts likely to be encountered throughout life. Acquiring the ability to learn, for example, is key to harnessing the interaction of education with the job and other contexts occurring later in adult life.

In the meantime, however, it is useful to consider the implications of the findings for adults who are beyond the stage of formal schooling. The findings indicate that adult literacy proficiency is strongly related to their literacy related behaviours in the work environment as well as in the home, leisure and community contexts. Interpreting these findings within the framework of practice engagement theory implies that encouraging or supporting adults to engage in a variety of literacy related situations on a recurring basis would significantly contribute to the development of their literacy skills.

A strong relationship between the job and literacy proficiency indicates the important role of the economy, namely the production and occupational structures as well as work cultures, in the process of shaping individual adult literacy proficiencies. From a practice engagement perspective, the changing nature of the work environment is likely to be a key factor shaping the distribution and development of literacy proficiency over time.

From a research perspective, the findings are limited by the available data. The operationalization of factors would benefit from improved data that describe learning contexts in more detail, and thus improve the interpretability of the results. Furthermore, more detailed analyses of subpopulations and sub factors could yield interesting results. Ideally, longitudinal data would allow for better analyses that lead to an understanding of the skill formation process. In particular, the interactive and cumulative effects of learning that occur throughout the lifespan and in multiple settings.

References

- Anderson, R.C., Wilson, P.T., & Fielding, L.G. (1988). Growth in reading and how children spend their time outside of school. *Reading Research Quarterly*, 23 (3), 285-303.
- Aspin, D., Chapman, J., Hatton, M., & Sawano, Y. (Eds.) (2001). *International Handbook of Lifelong Learning*. Dordrecht: Kluwer.
- Baltes, P.B. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. *Developmental Psychology*, 23(5), 611-626.
- Beaton, A.E. (1997). Item sampling. In J.P. Keeves (Ed.), *Educational Research, Methodology and Measurement: An International Handbook, Second Edition* (pp. 840-846). Oxford: Pergamon Press.
- Bloom, B.S. (1964). *Stability and Change in Human Characteristics*. New York: Wiley.
- Bloom, B.S. (1976). *Human Characteristics and School Learning*. New York: McGraw-Hill.
- Boothby, D. (1999). *Literacy skills, the knowledge content of occupations and occupational mismatch*. Working Paper 99-3E, Applied Research Branch, Human Resource Development Canada, Hull.
- Boudard, E. (2001). *Literacy Proficiency, Earnings and Recurrent Training: A Ten Country Comparative Study*. Stockholm: Institute of International Education, Stockholm University.
- Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Campbell, J.R., Kelly, D.L., Mullis, I.V.S., Martin, M.O., & Sainsbury, M. (2001). *Framework and Specifications for PIRLS Assessment*. PIRLS International Study Center, Boston College, Boston.
- Cropley, A.J. (1980). *Towards a System of Lifelong Education*. Oxford: Pergamon Press.
- Crowther, J., Hamilton, M., & Tett, L. (2001). *Powerful Literacies*. Leicester: National Organisation for Adult Learning.
- Dave, R.H. (1976). *Foundations of Lifelong Education*. Hamburg: UNESCO Institute of Education.
- Elley, W.B (1992). *How in the World Do Students Read?* The Hague: International Association for the Evaluation of Educational Achievement.
- Elsdon, K.T. (1991). *Adult Learning in Voluntary Organizations, Volume 1, Case Studies 1 & 2*. Department of Adult Education, University of Nottingham.
- Gray, W.S. (1956). *The Teaching of Reading and Writing: An International Survey*. Chicago: Scott Foresman.

- Guthrie, J.T. & Greaney, V. (1991). Literacy acts. In R. Barr, M.L. Kamil, P. Mosenthal & P.D. Pearson (Eds.), *Handbook of Reading Research, Volume II* (pp. 68-96). New York: Longman.
- Hautecoeur, J.P. (Ed.) (2000). Literacy in the Age of Information – Knowledge, Power or Domination? An Assessment of the International Adult Literacy Survey. *International Review of Education*, 46(5), 357-473.
- Haskell, R.E. (2001). *Transfer of Learning: Cognition, Instruction, and Reasoning*. New York: Academic Press.
- Hess, R.D., & Holloway, S.D. (1984). Family and school as educational institutions. In R.D. Parke (Ed.), *Review of Child Development Research, Volume 7: The Family* (pp.179-222). Chicago: University of Chicago Press.
- Horn, J.L., & Hofer, S.M. (1992). Major abilities and development in the adult period. In R.J. Sternberg & C.A. Berg (Eds.), *Intellectual Development* (pp. 44-49). New York: Cambridge University Press.
- Hoyle, R.H., & Panter, A.T. (1995). Writing about structural equation models. In R.H. Hoyle (Ed.), *Structural Equation Modeling: Concepts, Issues and Applications* (pp. 158-176). London: Sage.
- Iverson, B.K., & Walberg, H.J. (1982). Home environment and school learning: A quantitative synthesis. *Journal of Experimental Education*, 50(3), 144-151.
- Jones, S. (1999). *Skill use and acquisition*, in 'International Life Skills Survey Frameworks: Working Drafts'. Background documentation prepared for the meeting of Adult Literacy and Life Skills Survey National Study Managers, September 1999.
- Jöreskog, K.G. (1969). A general approach to confirmatory maximum likelihood factor analysis. *Psychometrika*, 34(2), 183-202.
- Jöreskog, K.G., & Sörbom, D. (1990). Linear structural relations analysis. In T. Husen & T.N. Postlewaite (Eds.), *International Encyclopedia of Education, Supplementary Volume II* (pp.368-376). Oxford: Pergamon Press.
- Kapsalis, C. (1997). *Employee Training: An International Perspective*. Ottawa and Hull: Statistics Canada and HRDC.
- Keeves, J.P., & Adams, D. (1997). Comparative methodology in education. In J.P. Keeves (Ed.), *Educational Research, Methodology and Measurement: An International Handbook, Second Edition* (pp. 31-41). Oxford: Pergamon Press.
- Kirsch, I.S., & Jungeblut, A. (1997). Using large-scale assessment results to identify and evaluate generalizable indicators of literacy. In A. C. Tuijnman, I. S. Kirsch & D. A. Wagner (Eds.), *Adult Basic Skills: Innovations in Measurement and Policy Analysis* (pp. 187-207). Cresskill, NJ: Hampton Press, Inc.
- Kirsch, I. S., Jungeblut, A., Jenkins, L., & Kolstad, A. (1993). *Adult Literacy in America: A First Look at the Results of the National Adult Literacy Survey*. Princeton, NJ: Educational Testing Service.
- Kirsch, I. S., Jungeblut, A., & Mosenthal, P.B. (1998). The measurement of adult literacy. In T.S. Murray, I.S. Kirsch & L.B. Jenkins (Eds.), *Adult Literacy in OECD*

- Countries: Technical Report on the First International Adult Literacy Survey* (pp. 105-134). Washington, DC: National Centre for Education Statistics.
- Krahn, H., & Lowe, G.S. (1998). *Literacy Utilization in Canadian Workplaces*. Ottawa and Hull: Statistics Canada and Human Resource Development Canada.
- Kreppner, K., & Lerner, R. (Eds.) (1989). *Family Systems and Life-span Development*. Hillsdale, NJ: Erlbaum.
- Loertscher, D.V. (1993). Objective: Achievement. Solution: School libraries. *School Library Journal*, 39(5), 30-35.
- Lynch, L.M. (1992). Private-sector training and the earnings of young workers. *American Economic Review*, 82(1), 299-312.
- Marsiske, M., & Smith, J. (1998). Development of competence: Toward a taxonomy. In T. Husén & T. N. Postlethwaite (Eds.), *International Encyclopedia of Education* (Electronic edition). Oxford: Pergamon Press.
- Massé, P., Roy, R., & Gingras, Y. (2000). The changing skill structure of employment in Canada. In K. Rubenson & H. G. Schuetze (Eds.), *Transition to the Knowledge Society: Policies and Strategies for Individual Participation and Learning*. Vancouver, BC: British Columbia Press.
- Meissner, M. (1971). The long arm of the job: A study of work and leisure. *Industrial Relations: Journal of Economy & Society*, 10, 239-260.
- Meyer, B.J., Young, C.J., & Bartlett, B.J. (1993). Reading comprehension and the use of text structure across the adult lifespan. In S.R. Yussen & M.C. Smith (Eds.), *Reading Across the Life Span* (pp. 165-192). New York: Springer-Verlag.
- Moos, R.H. (1991). Connections between school, work, and family settings. In B.J. Fraser & H.J. Walberg (Eds.), *Educational Environments: Evaluation, Antecedents, and Consequences* (pp.29-53). Oxford: Pergamon Press.
- Murray, T.S., Kirsch, I.S. & Jenkins, L.B., (Eds.) (1998). *Adult Literacy in OECD Countries: Technical Report on the First International Adult Literacy Survey*. Washington, DC: National Centre for Education Statistics.
- OECD & Statistics Canada (2000). *Literacy in the Information Age: Final Report on the International Adult Literacy Survey*. Paris and Ottawa: Author.
- OECD & HRDC (1997). *Literacy Skills for the Knowledge Society: Further Results from the International Adult Literacy Survey*. Paris and Hull: Author.
- Raudenbush, S.W., & Kasim, R.M. (1998). Cognitive skill and economic inequality: Findings from the national adult literacy survey. *Harvard Educational Review*, 68 (1), 33-79.
- Reder, S. (1998). Literacy selection and literacy development: Structural equation models of the reciprocal effects of education and literacy. In MC. Smith (Ed.), *Literacy for the Twenty-first Century: Research policy, practices and the National Adult Literacy Survey* (pp. 139-157). Westport, CT: Praeger.
- Reder, S. (1994). Practice-engagement theory: A sociocultural approach to literacy across languages and cultures. In B.M. Ferdman, R.M. Weber & A.G. Ramirez

- (Eds.), *Literacy Across Languages and Cultures* (pp.33-74). Albany: State University of New York Press.
- Rubenson, K. (1987). Participation in recurrent education: A research review. In H.G. Schuetze & D. Istance (Eds.), *Recurrent Education Revisited: Mode of Participation and Financing* (pp. 39-67). Stockholm: Almqvist & Wiksell International.
- Rubenson, K., & Schuetze, H.G. (1995). Learning at and through the workplace: A review of participation and adult learning theory. In D. Hirsch & D.A. Wagner (Eds.), *What Makes Workers Learn* (pp.95-116). Cresskill, NJ: Hampton Press.
- Schaie, K.W. (1994). The course of adult intellectual development. *American Psychologist*, 49(4), 304-313.
- Sheehan-Holt, J.K., & Smith, M.C. (2000). Does basic skills education affect adults' literacy proficiency and reading practices? *Reading Research Quarterly*, 35(2), 226-243.
- Simmons, D. (1994). It takes more than a book talk: Prereading strategies. *Emergency Librarian*, 21(5), 18-23.
- Siegel, D.F., & Hanson, R.A. (1992). Prescription for literacy: Providing critical educational experiences. *ERIC Digest*, ERIC Clearinghouse on Reading and Communication Skills, Bloomington, IN.
- Smith, M.C. (1996). Difference in adults' reading practices and literacy proficiency. *Reading Research Quarterly*, 31(2), 196-219.
- Smith, M.C. (1993). Change in reading ability and attitudes from childhood to adulthood: A life span perspective. In S.R. Yussen & M.C. Smith (Eds.), *Reading Across the Life Span* (pp. 273-292). New York: Springer-Verlag.
- Smith, J., & Marsiske, M. (1997). Abilities and competencies in adulthood: Lifespan perspectives on workplace skills. In A.C. Tuijnman, I.S. Kirsch & D.A. Wagner (Eds.), *Adult Basic Skills: Innovations in Measurement and Policy Analysis* (pp. 73-114). Cresskill, NJ: Hampton Press, Inc.
- Strober, M.H. (1997). Gender and occupational segregation. In L.J. Saha (Ed.), *International Encyclopaedia of the Sociology of Education* (pp. 545-549). Oxford: Pergamon Press.
- Stromquist, N.P. (1997). Gender and education. In L.J. Saha (Ed.), *International Encyclopaedia of the Sociology of Education* (pp. 539-544). Oxford: Pergamon Press.
- Taylor, B.M., Frye, B.J., & Maruyama, G.M. (1990). Time spent reading and reading growth. *American Educational Research Journal*, 27(2), 351-362.
- Tuijnman, A.C., & Boudard, E. (2001). *Adult Education in North America: An International Comparative Study*. Washington, DC: U.S. Department of Education.
- Tuijnman, A.C., & Keeves, J.P. (1997). Path analysis and linear structural relations analysis. In J.P. Keeves (Ed.), *Educational Research Methodology and Measurement: An International Handbook, Second Edition* (pp.621-633). Oxford: Pergamon Press.

- Tuijnman, A.C. (1991). Lifelong education: A test of the accumulation hypothesis. *International Journal of Lifelong Education*, 10(4), 275-285.
- UNESCO (1978). *Records of the General Conference: Resolutions, Volume 1*. Paris: UNESCO.
- Venezky, R.L. (1997). Literacy assessment in the service of literacy policy. In A.C. Tuijnman, I.S. Kirsch & D.A. Wagner (Eds.), *Adult Basic Skills: Innovations in Measurement and Policy Analysis* (pp. 311-336). Cresskill, NJ: Hampton Press.

The effect of literacy proficiency on earnings: An aggregated occupational approach using the Canadian IALS data

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Abstract

A measure of literacy proficiency from the Canadian Adult Literacy Survey is included in an analysis that is aimed at explaining differences in individual earnings. The approach adapts a labour segmented view of the labour market by aggregating occupations into seven types, enabling the estimation of the variable impact of literacy proficiency on earnings, both within and between different types of occupations. This is done using the Hierarchical Linear Modelling method. Substantial premiums are found to be associated with some occupational types even after adjusting for within occupational differences in individual characteristics such as schooling, literacy proficiency, labour force experience and gender. Average years of schooling and average levels of literacy proficiency at the between level account for over two-thirds of the premiums. Within occupations, there are significant returns to schooling but they vary depending on the type of occupations. In contrast, the within occupational return of literacy proficiency is not necessarily significant. The latter depends on the type of occupation.

Keywords: human capital, rate of return, salary wage differentials

1. Introduction

1.1 Background

Data available from the IALS offers a direct measure of literacy proficiency, which indicates a particular type of skill, namely literacy skills. These are believed to be vitally important skills, because they provide a fundamental means to acquire knowledge and skills in a variety of other contexts. They are needed to learn print-based material, to communicate and not least to inform decision-making at all levels. Thus they are likely to be relevant for productivity and hence earnings in all occupations. In this sense literacy involves general skills that are applicable to everyone. They are not all inclusive indicators of human capital, however, they are believed to be foundation skills that facilitate the acquisition of other more specific types of human capital.

Even though they are likely to be important and relevant for all, the IALS data shows that there are observed differences in levels of literacy proficiency among individuals. Furthermore, the relevance of literacy proficiency and its impact on productivity and hence earnings is likely to vary according to different types of occupations. For example, occupations in which tasks are dominated by the involvement of print-based material or other information processing tasks are more likely to demand and hence reward literacy proficiency than other occupations that are dominated by manual tasks.

While literacy may be more relevant in some occupations, recent trends including technically-biased change and the increasing use of Information Communication Technologies (ICTs) have perhaps increased the relevance of literacy proficiency in all occupations and will continue to do so. For this reason, it is useful to consider the effect of literacy proficiency on earnings, while at the same time acknowledging that its impact on productivity is likely to depend on the type of occupation.

Previous research suggests that literacy skills, as measured by the IALS, have an impact on labour market outcomes, including less unemployment, higher earnings and a greater probability of being in a high-skilled occupation, independent of educational attainment. In particular, Green and Riddell (2001) find that in Canada literacy skills as measured by IALS have a significant effect on earnings, which is above and beyond the effect of education. Using a Mincerian type approach, they attribute the earnings effects of literacy proficiency to cognitive skills, and the effect of education to non-cognitive skills, such as teamwork and interpersonal skills. They find that there are

significant returns to literacy proficiency on the order of 3.0 to 3.5 per cent for every 10-point increase (on a scale from 0 to 500) in literacy proficiency¹.

Green and Riddell (2001) and other analyses, which have produced similar findings, did not consider the potential heterogeneity of labour markets, in terms of the relevance of literacy proficiency to productivity and hence earnings. Thus findings tend to be highly aggregate and may conceal important differences in terms of the impact of literacy skills on earnings in different occupations. The analysis presented in this study follows Raudenbush and Kasim (2002), which uses the National Adult Literacy Survey (NALS) data and thus only considered the American labour market.

1.2 Aims and significance of the study

The purpose of this study is to use a hierarchical linear framework to explore the relationship between literacy proficiency and earnings. Within this framework the effect of literacy proficiency on earnings is disaggregated into a between and within occupational effect. The second aim is to adapt an aggregated occupational approach, which is conducive to hierarchical linear modelling and necessary to fulfil the first aim. Following previous research, this approach defines occupational types in terms of their typical job tasks and the broad skill types required to complete them. The third aim is to interpret the findings in terms of existing theories of wages.

The analysis places an emphasis on the following set of hypotheses:

- Different occupational types are systematically associated with different levels of earnings, even after adjusting for individual characteristics, which points to the fact that there are specific occupational characteristics that influence earnings.
- Literacy proficiency is a significant factor explaining the observed variation in earnings between occupational types. Therefore, the between occupational effect is expected to be significant. In particular, returns are expected to be associated with occupational types in which cognitive skills are the most relevant for carrying out occupational tasks.
- Literacy proficiency affects earnings within occupational types, so that those with higher literacy proficiency earn more than others who share the same type of occupation but have lower literacy proficiency. Therefore, the within occupational effect is expected to be significant.

¹ These returns are for weekly log earnings, which is the metric used in this study.

- The within occupational effect of literacy proficiency on earnings is expected to be stronger in occupational types in which cognitive skills are the most relevant for carrying out occupational tasks.

The study reported here is significant in at least three respects. Firstly, it makes use of a direct measure of human capital when attempting to estimate the impact of skills on earnings. The literacy proficiency measure from IALS is used in order to supplement other less precise indicators such as years of schooling.

Secondly, a labour-segmented view of labour markets is adapted from a human capital perspective. That is labour markets are segmented according to the skills set required to work in those jobs. It is assumed that the relevance of broad skill types differs according to the typical job tasks that characterize different occupational types. This view acknowledges heterogeneity in labour markets and allows the effect of literacy proficiency on earnings to vary according to its relevance in different occupational types.

Thirdly, an aggregated occupational approach is adapted according to the labour-segmented view discussed above. This allows for hierarchical linear modelling, which disaggregates the observed effect of human capital indicators into between and within occupational effects. The findings that arise are challenging to interpret but nevertheless broaden the perspective and offer interesting insights.

2. Theory and previous research

2.1 Theoretical perspective

There are a variety of theories that can contribute to an explanation of the observed inequality in individual earnings. Many of them relate to each other and can be used in combination to add explanatory value. A useful starting point is the neoclassical economic framework, in which it is implied that individuals who contribute more to the final value of production should also earn more. Complementing this is the theory of human capital (Schultz, 1961, 1975; Becker, 1962, 1964; Mincer, 1958, 1962, 1974), whose core premise suggests that the relative contribution of individuals depends on the knowledge, skills and other attributes embodied within them (Blaug, 1976).

On this basis, those with more human capital, holding all other variables constant, should be more productive. The following elaborates on an important assumption associated with this proposition, namely the existence of a single and fair labour market, one that distributes jobs and pay strictly on the basis of

worker qualifications, and that knowledge and skills are of pre-eminent importance in the labour market.

In reality, human capital is multi-faceted and certain types of skills may be more relevant in some occupations than others, giving rise to a labour-segmented view of the labour market. Introducing a labour-segmented view relaxes the assumption of a single labour market. Moreover, depending on how it is operationalized, it can also acknowledge the complexity and diversity of human capital, where some skills are more important in some occupations than others.

The theory of labour-segmented markets, which was popularised by Doeringer and Piore (1971), has traditionally differed from human capital theory in terms of its focus. It has tended to emphasize the characteristics of jobs and job markets, rather than the characteristics of individuals (Duncan & Hoffman, 1979). The theory suggests that different labour markets operate under different circumstances such as regulations, technology, demand and supply, which leads to varying pays and benefits. Many proponents of the theory have suggested that worker productivity and pay are determined more by the job and its technology than by the human capital of the worker (see Velloso, 1995). These conclusions are mostly based on studies that view labour-segmentation as a function of industry. In many such studies, job characteristics are not viewed from the point of view of the individual characteristics (i.e., human capital) needed to carry out occupational tasks.

In contrast, there are other studies (e.g., Osberg, Wolff & Baumol, 1989; Raudenbush & Kasim, 2002) that have considered labour-segmentation as a function of occupation. This approach explicitly makes individual characteristics such as human capital relevant, since they are needed to carry out the tasks of different occupations. Osberg *et al.* (1989) state that because of subcontracting and other developments, industry-based classifications of economic activity are becoming increasingly unreliable, and thus there is a need to emphasize the occupational composition of the labour force.

The latter approach to viewing labour-segmentation allows for the possibility to consider whether the returns to qualifications and skills vary by different types of occupations. Many studies ignore this and by extension the different types of qualifications and skills that are needed to complete the tasks of those occupations. For example, years of schooling regardless of whether they are vocationally oriented or comprehensive, are often treated as equivalent in studies estimating the impact of schooling and/or skills on earnings. Similarly whether an individual is employed on a factory-line or in a position with a lot of decision making responsibility is often ignored. This is no doubt in part due to

data limitations. But the differentiation of these factors is likely to be important when estimating the impact of human capital on earnings.

Another important theory that relates to the analysis undertaken in this study is signalling theory (Arrow, 1973; Spence, 1973; Stiglitz, 1975; Riley, 1976; Weiss, 1995). Because employers have imperfect information concerning potential employees, such as their ability and future productivity, they face a dilemma when they are hiring. So they have little choice but to infer applicants' abilities to produce by relying on their qualifications that are validated and recognised, such as educational attainment. In short, the theory suggests that education acts as a signalling, or screening device for unobserved characteristics. Even though education is only a proxy for human capital, it is suggested that it is vitally important by serving as screening or filtering function. Indeed, there are findings (e.g., Black & Lynch, 1996: 266), which suggests that educational credentials are important to employers when hiring, and thus play an important role in providing access to occupations.

Signalling theory is important when interpreting the findings of this study because literacy proficiency is difficult to observe. The IALS offers a direct measure that is used in this study but employers do not generally have the tools to directly measure literacy proficiency. Therefore, because literacy proficiency may not be precisely observed in the day to day functioning of the labour market, it is interesting to observe whether they are rewarded above and beyond officially recognized credentials², which usually act as proxies for skills.

2.2 *Previous research*

There is an extensive body of research literature devoted to the study of factors that can explain observed earnings differentials. Some of the major theories commonly put forth have already been discussed. The aim in this section is to provide a brief overview of previous empirical research that is relevant to the study of human capital.

The correspondence between the various factors (i.e., home background, schooling, work and other experience, etc...) that are thought to form human capital and the actual knowledge, skills and other attributes embodied in individuals, leads to an auxiliary assumption in the human capital framework. In practice, it is difficult to observe the contribution of different factors. As a consequence, it is difficult to know with any certainty that changes to human capital if they are occurring at all are the result of specific learning occurrences,

² Due to sample limitations, this study only considers years of schooling as credentials, and not educational attainment.

and not unobserved factors (i.e., innate ability). In general, this creates a lack of information about the human capital formation process, in particular for education and training industries but also for economies and societies more generally.

Without direct measures of human capital, empirical studies are constrained by the assumption that those with a specified level of education possess similar knowledge, skills and other attributes. But there may be evidence to the contrary since people with the same level of schooling do not necessarily earn the same. Despite experiencing similar schooling, differences in human capital may in part remain as a result of differing experiences that occurred prior, during or after schooling as well as other unobserved characteristics such as innate ability.

Using direct measures allows for specific skills to be separately valued from the many characteristics that education is supposed to indirectly measure. It also allows for an improved understanding of the correspondence between the inputs and outputs of the human capital formation process. If a particular skill is valued independently from schooling, then schooling may continue to proxy for other characteristics. Singling out specific skills and valuing them is a potentially useful exercise since it can lead to policies, which will target certain skill development and maintenance throughout working life.

A lack of available data concerning knowledge and skills has invariably led to contestable findings about the skill formation process. Combining this with the poor availability of data concerning the productivity of workers, the merit of human capital theory has often been reduced to a test of its ability to explain earnings differentials on the basis of differences in the quantity of education, training and experience of workers; rather than its ability to explain productivity differences on the basis of differences in the personal knowledge, skills and other attributes of workers. In general, findings have proved useful, but much of the current evidence about the effects of learning on productivity and well being rests on assumptions that are untestable because the necessary data are lacking (Stern & Tuijnman, 1997).

In recent years, intense efforts to make direct measures of skills available for research have been made. One such example includes the direct measures of literacy proficiency made available through the International Adult Literacy Survey (IALS), which are used in this study. Accounting for literacy skills, offers a unique opportunity to enrich analyses and explore hypotheses concerning the relationship between skills and earnings in greater detail. They are merely one aspect of human capital, but the manner in which they are defined makes them a good proxy of general skills. The IALS defined literacy in terms of a mode of adult behaviour – to use printed and written information to function in society (Murray, Kirsch & Jenkins, 1998: 17) – and as such

indicates skills that are needed to master daily life tasks. Moreover, direct measures of literacy skills complement the quantity of education, by potentially accounting for quality differences in schooling as well as some of the learning that occurs beyond initial schooling.

As already mentioned, Green and Riddell (2001), adjust for literacy proficiency and educational attainment simultaneously using a Mincerian type approach. They use the Canadian IALS data and find significant returns to literacy proficiency on the order of 3.0 to 3.5 per cent for every 10-point increase in literacy. While controlling for literacy proficiency, OECD and HRDC (1997) also find that the effect of education on earnings is reduced. Osberg (2000: 8) reports results indicating that 40 to 45 per cent of the economic return to education is attributable to literacy proficiency, which implies that education yields other outcomes.

There are numerous other studies using direct assessments of skills. Murnane, Willet and Levy (1995) shows the importance of basic skills has increased between the 70s and mid 80s. In Murnane, Willet, Braatz and Duhaldeborde (2001), three types of skills are examined, namely academic skills, skills at completing elementary tasks quickly, and self-esteem, confirming the importance of basic skills in the US labour market. Riviera-Batiz (1992), using the Young Adult Literacy Survey (YALS) data, shows that quantitative literacy also has an independent effect on earnings over and above the effect of initial education.

Evidence suggests that the returns to literacy skills can substantially vary between countries. For example, Devroye and Freeman (2001) conclude that the United States sort people by literacy proficiency more than any other country. Blau and Kahn (2001) confirm this by suggesting that knowledge and skills play a significant role in explaining relatively high U.S. wage inequalities. Leuven (2001) also finds that the relation between schooling and cognitive scores is steeper in the U.S. than in other countries. In contrast, Tuijnman (2000) finds that the Polish labour market pays for educational qualifications and for work experience but does not highly reward literacy skills.

Findings also suggest that returns to skills vary by occupation. Using the National Adult Literacy Survey (NALS) data, Raudenbush and Kasim (2002) borrow Osberg et al.'s (1989) labour-segmented view of an information economy to explore the relationships among social inequalities, inequality in literacy skills and inequality in employment and earnings, both within and between occupational types. They associate "good" occupations with relatively well paying information occupations. In their analysis, the average effect of literacy skills was approximately 25 per cent of the contribution of education to earnings. A one standard deviation increase in literacy proficiency was

associated with an approximate 18 per cent increase in hourly earnings, but this varied by occupational type. For example, they find that in the American labour market the relationship between literacy skills and earnings is steeper in information occupations than non-information occupations.

3. Methodology

3.1 Data

The Canadian data from the International Adult Literacy Survey (IALS, 1994) is used for this study. The sample includes 25 to 59 year-olds that were either employed or unemployed and looking for work at the time of the survey. Restricting the sample from 25 to 59 year-olds was to maintain some comparability with the estimates reported in Raudenbush and Kasim (2002) for the US, which is a study that produces similar estimates. Table 1 provides the descriptive statistics for the variables considered in this study. The weight variable was used throughout since the IALS in Canada involved a complex survey design. Missing data for the earnings variable were imputed using the EM method available in SPSS.

Table 1. Descriptive Statistics

	Scale	Mean	Standard deviation	Missing data	Imputed	Sample
Occupational types	Ordinal	--	--	--	--	2092
Years of schooling	Continuous	13.18	3.48	--	--	2092
Literacy proficiency ^a	Continuous	292.02	58.70	--	--	2092
Log-labour force experience ^b	Continuous	5.80	1.11	--	--	2092
Male	Dichotomous	0.56	0.50	--	--	2092
Weekly log-earnings	Continuous	6.31	0.75	435	0	1657
Weekly log-earnings (imputed) ^c	Continuous	6.37	0.54	435	435	2092

Source: Canadian International Adult Literacy Survey, 1994.

Notes:

- Literacy proficiency was calculated as the average of prose, document and quantitative literacy proficiencies (see OECD & Statistics Canada, 2000).
- Calculated as the log of age minus years of schooling minus six.
- Missing data were imputed using the EM method available in SPSS.

3.2 *Classification of aggregated occupational types*

Shifts in occupational structures in favour of high-skilled occupations and evidence of a general “upskilling” within most occupations (OECD, 2001) suggests it is important to consider how the relationship between the distribution of skills and earnings can vary between different occupational types. For example, it is expected that literacy skills are more relevant to occupations within the information economy. In order to consider this proposition in a tractable way, it is useful to group occupations in relatively few categories, which are distinguished by common expectations and broad skill types. This section discusses select attempts to reclassify occupations for specific analyses set within an information economy context, including the one used for further analyses. For more detailed profiles of skills in relation to occupations, see the Essential Skills Project outlined in HRDC (2001).

The aggregated occupational approach originates from a study by Wolff and Baumol (1989), who classify occupations as either belonging to the information or non-information sectors of the economy, in order to decompose shifts in the occupational structure of the U.S. economy over the period 1960 to 1980. Within the information-producing sector, they distinguish between occupations that produce ‘knowledge’ and those that produce ‘data’. The occupations that produce knowledge are described as being involved in the generation and dissemination of new conceptual categories, relationships, and hypotheses; and those that produce data are described to be involved in the manipulation, transmission, and storage of symbolic information within previously defined categories (Osberg et al., 1989: 2). ‘Goods’ and ‘service’ occupations are considered non-information occupations.

Using a similar approach, Lavoie and Roy (1998) reclassify Canadian occupational data to consider the relative growth of knowledge workers as a potential factor affecting the composition of final output, productivity shifts and intra-industry substitution between different types of workers. They modify Wolff and Baumol’s classification by adding a ‘management’ category, and take the latter’s combined ‘data/services’ category into account. Added emphasis is placed on the role of ‘knowledge’ occupations in the economy and this category is further sub-divided into 5 categories: pure science, applied science, computer science, engineering and social sciences and humanities. The rationale used to classify occupations into the six main categories involves a subjective analysis of the typical tasks performed by workers in different occupations as well as their typical knowledge base.

Raudenbush and Kasim (1998, 2002) also use Wolff and Baumol’s classification scheme. Using the U.S. National Adult Literacy Survey (NALS)

data, they apply a Hierarchical Linear Modelling (HLM) approach to investigate gender and ethnic discrimination between and within aggregated occupations in terms of economic inequalities, holding social inequalities in schooling and literacy skills constant.

Boothby (1999) and Béjaoui (2000) extend the research of Lavoie and Roy (1998), which leads to an advanced reclassification of occupational data in terms of required skill types. Using Principal Components Analysis among 43 indices, Béjaoui (2000) finds clusters representing five broad skill types: authority-management skills; cognitive skills; communication skills; gross motor skills; and fine motor skills. Béjaoui constructs the indices by giving scores to each occupation based on the requirements described in the 1971 Canadian Classification and Dictionary of Occupations (CCDO), which represent general education, physical abilities and other different aptitudes. Boothby (1999) builds on the work of Béjaoui and reclassifies occupations into seven categories: 'knowledge', 'management', 'data', 'data manipulation', 'services', 'skilled goods', and 'other goods'. To do this, Boothby performs a Discriminant Analysis, which treats the occupational category as the classification variable and Béjaoui's five skill type scores as the basis for classification.

The reclassification scheme outlined in Boothby (1999) is the one used for the analysis presented in this study. The approach uses a rigorous and consistent criterion to reclassify occupations on the basis of required skills, namely Béjaoui's (2000) broad skill type scores. Note that the category labels derived by Boothby (1999) and used in this study are different than in the other studies mentioned (e.g., Osberg et al.'s, 1989; Raudenbush & Kasim, 1998, 2002; Lavoie & Roy, 1998). By using a more rigorous approach, Boothby (1999) found considerable variation in the nature of the occupational tasks within the categories defined in previous studies. This led to a modified aggregated occupational classification with additional occupational types.

Appendix A outlines the assignment of 4-digit 1980 Standardized Occupational Classification (SOC) codes to seven categories: 'knowledge', 'management', 'data', 'data manipulation', 'services', 'skilled goods', and 'other goods'. Table 2 provides descriptive statistics for the variables used in the analysis by occupational types.

Table 2. Descriptive statistics by occupational types

Occupational types	Sample size	Years of schooling		Literacy proficiency		Log labour force experience		Male		Weekly log-earnings	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Knowledge	111	17.2	2.7	331.8	44.3	2.5	0.7	0.8	0.4	6.8	0.4
Management	220	13.7	3.2	307.2	41.4	2.9	0.5	0.6	0.5	6.7	0.5
Data	515	15.5	2.8	323.2	42.2	2.8	0.5	0.5	0.5	6.5	0.5
Data manipulation	407	13.4	2.7	294.7	47.0	2.9	0.6	0.3	0.4	6.1	0.5
Service	209	11.5	2.7	273.5	52.4	3.0	0.6	0.4	0.5	5.9	0.6
Skilled goods	201	11.4	2.7	279.8	59.0	3.1	0.4	0.9	0.3	6.6	0.4
Other goods	429	10.6	3.0	248.8	66.3	3.0	0.5	0.8	0.4	6.3	0.5
All occupations	2092	13.2	3.5	292.0	58.7	2.9	0.6	0.6	0.5	6.4	0.5

Source: Canadian International Adult Literacy Survey, 1994.

3.3 Hierarchical Linear Modeling

A Hierarchical Linear Modelling (HLM) approach is used in this study. The following briefly presents the methodology involved. See Bryk and Raudenbush (1992) for a more detailed presentation of HLM. Essentially, the approach involves a two level analysis. In the context of this study, the unit of analysis at level 1 is individuals and at level 2 occupational types as per their derivation discussed above. The sub model at level 1 follows a typical linear regression format as depicted in equation (1), where j represents the occupational type ($j=1, \dots, J$) and there are l independent variables included at level 1 ($l=1, \dots, L$).

$$Y_j = \gamma_0 + \gamma_1 X_{1,j} + \dots + \gamma_l X_{l,j} + r_j \quad (1)$$

At level 2, the level 1 coefficients (i.e., $\gamma_0, \gamma_1, \gamma_2, \dots, \gamma_l$) become outcome variables. As depicted in equation (2), the coefficients are equal to a fixed effect (γ_{l0} , where $l=0, \dots, L$ represents the number of level 1 coefficients), plus non-random ($\gamma_{l0}, \gamma_{l1}, \gamma_{l2}, \dots, \gamma_{lk}$, where $k=0, \dots, K$ are the number of independent variables at level 2) and random effects ($u_0, u_1, \dots, u_l$). Values of the independent variables at level 2 are the means computed for each occupational type. A fixed effect signifies the portion of the effect that is consistent across all occupational types. In the context of this study, it is essentially the average of all within occupational effects. A non-random effect signifies the portion of the effect that varies with the corresponding independent variable at level 2. This is interpreted as the

between effect of a particular variable. The random effect is a residual, signifying the variability in the level 1 parameter that is not captured by the independent variables included at level 2.

$$\begin{aligned}
\gamma_0 &= \gamma_{00} + \gamma_{01}(\bar{X}_{1j}) + \dots + \gamma_{0k}(\bar{X}_{mj}) + u_0 \\
\gamma_1 &= \gamma_{10} + \gamma_{11}(\bar{X}_{1j}) + \dots + \gamma_{1k}(\bar{X}_{mj}) + u_1 \\
&\vdots \\
\gamma_l &= \gamma_{l0} + \gamma_{l1}(\bar{X}_{1j}) + \dots + \gamma_{lk}(\bar{X}_{mj}) + u_l
\end{aligned} \tag{2}$$

If the fixed component of a parameter is not significant but nevertheless has a significant random effect, then this implies that the corresponding predictor may continue to be relevant, but not necessarily for all of the occupational types. It also implies that the parameter estimates vary considerably according to the occupational type. When this is the case, it is useful to individually report the within effect for each occupational type, as depicted in (3). Note that in (3) the level 2 intercept reflects the base estimate for the reference group, namely occupation J. That is, the base parameters (i.e., $\gamma_{00}, \dots, \gamma_{0l}$) are the parameters for occupational type J, and the parameter estimates for the remaining occupational types (i.e., 1, ..., 1-J) must be calculated by adding the other parameters (i.e., $\gamma_{01}, \dots, \gamma_{0(J-1)}$) to the base parameters.

$$\begin{aligned}
\gamma_0 &= \gamma_{00} + \gamma_{01}(j=1) + \dots + \gamma_{0(J-1)}(j=J-1) \\
\gamma_1 &= \gamma_{10} + \gamma_{11}(j=1) + \dots + \gamma_{1(J-1)}(j=J-1) \\
&\vdots \\
\gamma_l &= \gamma_{l0} + \gamma_{l1}(j=1) + \dots + \gamma_{l(J-1)}(j=J-1)
\end{aligned} \tag{3}$$

The rest of this section discusses variance measures within the context of HLM, which are reported and used to interpret the results of the analysis. Equation (4) decomposes the observed variance for the dependent variable into two levels. The variance component at level 1 is denoted as Sigma-squared (σ^2), which indicates the variation at the individual level within occupational types. The between occupational type variance occurring at level 2 is denoted as Tau

(τ). It indicates the variability among occupational types in terms of the dependent variable. $\text{Var}(Y)$ is the sum of the variance occurring at both levels.

$$\text{Var}(Y) = \tau_{00} + \sigma^2 \quad (4)$$

Where,

$$\tau_{00} = \text{var}(u_{00})$$

$$\sigma^2 = \text{var}(r_{ij})$$

It is informative to separate the proportion of variance occurring at different levels of the hierarchy. As depicted by equation (5), rho (ρ) is a measure of the between occupational variance as a percentage of total variance. The remaining proportion occurs at level 1 among individuals nested within occupational types.

$$\rho = \frac{\tau_{00}}{(\tau_{00} + \sigma^2)} \quad (5)$$

The explained variance at levels 1 and 2 can be measured by observing the difference between the start model and the final model in both τ and σ^2 , respectively.

$$\text{Explained variance at level 1} = \frac{\sigma^2(\text{Model0}) - \sigma^2(\text{Model1})}{\sigma^2(\text{Model0})}$$

$$\text{Explained variance at level 2} = \frac{\tau_{00}(\text{Model0}) - \tau_{00}(\text{Model1})}{\tau_{00}(\text{Model0})}$$

Note that *Model 0* is the start model that is unconditional without any predictors at level 1 or level 2. Its σ^2 represents the total variance within occupational types that can be explained by any level 1 model. The variance that is explained by the addition of the level 1 predictor is estimated by observing the difference in σ^2 between the start model and the new model. The process is similar to determine the explained variance at level 2.

4. Model

The model adopted to estimate the effect of literacy proficiency on earnings closely follows the general Mincerian (1974) model, where the logarithm of individual earnings are expressed as a linear function of years of schooling, log-labour force experience, and other influences such as gender. But since the Mincerian approach is limited by the assumption of a single homogenous labour market, in which all human capital is assumed to be equivalently relevant, the current approach is extended, by incorporating a labour-segmented interpretation of the modern labour market as per the theoretical perspective discussed above. Raudenbush and Kasim (1998, 2002) pioneered and applied this extended approach by analysing the NALS data available for the United States. In this study, the Canadian portion of the International Adult Literacy Survey (IALS) is analysed.

As depicted in equation (6), there are $i=1,2,\dots,n_j$ individuals nested within $j=1,\dots,7$ occupational types.

$$\log Y_{ij} = \gamma_0 + G^S S_{ij} + G^Z Z_{ij} + r_{ij} \quad (6)$$

Where,

- Y_{ij} is the earnings of individual i in occupational type j
- S_{ij} is the level-1 vector of skills for individual i in occupational type j
- G^S are the level-1 coefficients associated with the vector of skills
- Z_{ij} is the level-1 vector of other predictors for individual i in occupational type j
- G^Z are the level-1 coefficients associated with the vector of other predictors
- r_{ij} is the level-1 random effect, with assumed distribution $r_{ij} \sim N(0, \sigma^2)$
- σ^2 is the variance of r_{ij} (i.e., level-1 variance)

Also using the general Mincerian approach, Green and Riddell (2001) introduce S suggesting that if all skills were observable and measurable, G^S could be interpreted as a vector of implicit prices, which estimates the economic value associated with each skill. But because not all skills are observed, they introduce two separate vectors, one for observed skills (S^o), and one for unobserved skills (S^u), as shown in equation (7). They suggest that S^u can be proxied by a set of inputs, namely education, experience and possibly others,

which are assumed to produce unobservable skills. Substituting (7) into (6) introduces equation (8), where $r_{ij}' = r_{ij} + v_i$.³

$$S_{ij} = (S_{ij}^o S_{ij}^u) = G^o S_{ij}^o + G^u S_{ij}^u + v_i \quad (7)$$

$$\log Y_{ij} = \gamma_0 + G^o S_{ij}^o + G^u S_{ij}^u + G^Z Z_{ij} + r_{ij}' \quad (8)$$

In (9), the directly observed measure of literacy skills (LIT), which is available in the International Adult Literacy Survey, is taken as S^o . In (10), years of schooling (ED) and log labour force experience (EXP) are taken as a set of inputs assumed to produce other unobservable skills. Finally, in (11), gender (MALE), which is known to be a highly significant predictor of individual earnings, is also adjusted for in all models. By substituting (9-11) in (8), the final sub model at level 1 is summarized by equation (12).

$$S_{ij}^o = \gamma_1 LIT \quad (9)$$

$$S_{ij}^u = \gamma_2 ED + \gamma_3 EXP \quad (10)$$

$$Z_{ij} = \gamma_4 MALE \quad (11)$$

$$\log Y_{ij} = \gamma_0 + \gamma_1 LIT + \gamma_2 ED + \gamma_3 EXP + \gamma_4 MALE + r_{ij}' \quad (12)$$

At level 2, mean values for years of schooling ($\overline{ED}_j$) and literacy proficiency ($\overline{LIT}_j$), which are calculated by occupational type, are included as independent variables to explain the observed variation in the intercept parameter from level 1. The corresponding level 2 parameters (i.e., γ_{01}) associated with these level 2 variables can be interpreted as the between occupational effect of that variable on earnings. Equations (13) and (14) depict the level 2 specifications for two successive models that are estimated and reported in the next section, namely Models 2 and 3, respectively.

³ Note that v_i is the measurement error associated with unobservable skills, which is correlated with S^u and earnings in (8), and may lead to bias in the parameters associated with schooling and experience. The latter two are used to measure unobservable skills. This is not considered further and presents a limitation to the current study. See Card (1999) for a discussion of the potential effect of unobserved variables, self-selection, misspecification and the measurement error of observed variables on bias.

$$\gamma_0 = \gamma_{00} + \gamma_{01}(\overline{ED}_j) + u_0 \quad (13)$$

$$\gamma_0 = \gamma_{00} + \gamma_{01}(\overline{LIT}_j) + u_0 \quad (14)$$

To observe more precise estimates of the within occupational effects of a particular independent variable, the results are reported according to the format discussed above in equation (3). This is done for Models 1B, 2B and 3B.

5. Results

The results of four models including a start model are reported in Table 2. Model 0 is the start model, which decomposes the variance of earnings into between and within occupational types. Model 1A is the basic model that estimates the fixed effects of each independent variable within occupational types, which are essentially the average within occupational effects for those variables. Model 1B estimates the wage differentials (or premiums) that remain between occupational types even after variables like years of schooling, experience, and literacy proficiency are adjusted for at the individual level. Models 2 and 3 focus on education and literacy proficiency, respectively, and disaggregate their effects on earnings into between and within occupational effects. While Models 2A and 3A estimate the fixed effects of education and literacy proficiency, respectively, which are essentially the average within occupational effects, Models 2B and 3B provide more precise estimates of the within occupational effects of each variable.

Model 0 estimates the variance components for the start model, which has no predictors at either the individual or occupational level. Results show that a significant proportion of the variation in weekly log earnings, approximately 27 per cent ($\rho=0.27$), occurs between occupational types. This can be referred to as the inter-occupational variation in earnings. The remaining variance occurs among individuals nested within occupational types.

Table 3A. Maximum likelihood coefficients for select hierarchical linear models, labour force participants in Canada aged 25 to 59, 1994

Variables	Model 0	Model 1A	Model 1B	Model 2A	Model 2B	Model 3A	Model 3B
Constant,G0							
Intercept, G00	6.40999	6.06761 *** (.0846)	5.97127 *** (.0410)	6.068134 *** (.0646)	6.064052 *** (.0737)	6.06771 *** (.0590)	6.06287 *** (.0674)
Knowledge			0.20978 ** (.1006)				
Management			0.36099 *** (.0623)				
Data			0.28650 *** (.0505)				
Data manipulation			0.02645 (.0479)				
Services			-0.34052 *** (.0589)				
Skilled goods			0.16481 * (.0985)				
Avg. years of schooling				0.055023 *** (.0093)	0.041162 (.0171)		
Avg. literacy proficiency						0.00502 *** (.0050)	0.00463 *** (.0010)
Literacy proficiency (LIT),G1							
Intercept, G10		0.00072 (.0004)	0.00064 (.0004)	0.00071 (.0004)	0.00074 (.0004)	0.00069 (.0004)	0.00206 *** (.0004)
Knowledge							-0.00117 (.0009)
Management							-0.00034 (.0008)
Data							-0.00165 *** (.0005)
Data manipulation							-0.00260 *** (.0006)
Services							-0.00187 ** (.0009)
Skilled goods							-0.00170 ** (.0007)
Years of schooling (ED),G2							
Intercept, G20		0.04098 *** (.0083)	0.03995 *** (.0090)	0.039035 *** (.0084)	0.021213 ** (.0101)	0.03908 *** (.0083)	0.03918 *** (.0089)
Knowledge					0.026344 (.0162)		
Management					-0.00256 (.0140)		
Data					0.007046 (.0115)		
Data manipulation					0.014112 (.0139)		
Services					0.068759 ** (.0217)		
Skilled goods					0.024303 (.0175)		
Log experience (EXP),G30		0.14914 ** (.0471)	0.14426 ** (.0514)	0.15199 ** (.0475)	0.15430 ** (.0508)	0.14951 ** (.0468)	0.15050 ** (.0498)
Male (MALE),G40		0.53252 *** (.0840)	0.53283 *** (.0914)	0.53396 *** (.0829)	0.53384 *** (.0894)	0.53555 *** (.0827)	0.53644 *** (.0895)

Source: Canadian Adult Literacy Survey (1994).

Notes:

* p < .05; ** p < .01; *** p < .001

In Models 1B, 2B and 3B, significance estimates reported by occupational types are based on a t-test of the statistical difference to the parameter from the reference group, namely 'other goods' occupations. Otherwise significance estimates are based on the standard t-test of the statistical difference to zero.

Table 3B. Variance statistics for select hierarchical linear models

	Model 0	Model 1A	Model 1B	Model 2A	Model 2B	Model 3A	Model 3B
Sigma-squared (σ^2) - level 1	0.24263	0.18042	0.18047	0.18045	0.18076	0.18023	0.18057
Tau (τ) - level 2	0.08872	0.05523	0	0.03207	0.03408	0.0268	0.02873
Total variance	0.33135	0.23565	0.18047	0.21252	0.21484	0.20703	0.20930
Variance at level 1 (%)	73.2						
Variance at level 2 (%) - Rho (ρ)	26.8						
Explained variance at level 1 (%)		18.8	18.8	18.8	18.7	18.8	18.7
Explained variance at level 2 (%)		10.1	26.8	17.1	16.5	18.7	18.1
Explained variance - combined (%)		28.9	45.5	35.9	35.2	37.5	36.8

Source: Canadian Adult Literacy Survey (1994).

Table 4. Variance components for unadjusted start model, model 0

	Variance in weekly log-earnings	
	Component	Proportion
Between occupations	$\tau = 0.09$	$\rho = 0.27$
Within occupations	$\sigma^2 = 0.24$	0.73
Total	0.33	1.00

Source: Canadian Adult Literacy Survey (1994).

5.1 Occupational premium

Results from Model 1B show that even after controlling for human capital variables at the individual level, including years of schooling, literacy proficiency and labour force experience, as well as gender, significant inter-occupational effects remain⁴. The effects are reported as occupational premiums, which are computed by taking the ratio of each occupational type's expected earnings to the expected earnings of 'other goods' occupations.

Information type occupations, including management followed by data and knowledge occupations are on average profiled with the highest premiums. But

⁴ Other variables indicating social origin such as non-native language status and parents' years of schooling were not found to have statistically significant effects and thus were removed from the analysis. See Green and Riddell (2001) for an analysis of the effect of literacy and education on earnings while controlling for immigrant status and parent's education. See also Raudenbush and Kasim (2002) for an extensive analysis of the effect of social origins on earnings inequalities in the American labour market using hierarchical linear modelling.

Table 5. Occupational premiums calculated as percentages relative to the expected weekly log-earnings of 'other goods' occupations, adjusted^a, model 1

	Maximum likelihood HLM coefficients	s.e.	t-value	Occupational premiums (%)
Constant-G0 (by occupation)				
Intercept-G00 (other goods=reference)	5.97127 ***	(0.041)	145.65	--
Change to reference group^b				
Knowledge	0.20978 **	(0.101)	61.47	21
Management	0.36099 ***	(0.062)	101.57	36
Data	0.28650 ***	(0.051)	123.84	29
Data manipulation	0.02645	(0.048)	125.30	3
Service	-0.34052 ***	(0.059)	95.65	-34
Skilled goods	0.16481 *	(0.099)	62.29	16

Source: Canadian Adult Literacy Survey (1994).

Notes:

* p < .05

** p < .01

*** p < .001

a. Results are adjusted for years of schooling, literacy proficiency, log-labour force experience and gender.

b. Significance estimates that are reported by occupational types are based on a t-test of the statistical difference to the parameter from the reference group, namely 'other goods' occupations. For this reason, t-values based on the standard t-test of the statistical difference to zero are reported separately. Otherwise, all significance estimates are based on the standard t-test of the statistical difference to zero.

those in skilled goods occupations earn significantly more than those in data manipulation occupations. Service occupations, of the non-information type, are profiled with the lowest average level of earnings, below 'other goods' occupations.

5.2 Schooling premium

Results for Model 2 show that adjusting for the average years of schooling at the occupational level, explains close to 64 per cent of the variance in earnings observed between occupations. The parameter estimate suggests that a one-year difference in the average years of schooling between occupational types represents an approximate 5.5 per cent difference in earnings. For example, a difference of 5.5 years in average schooling between those in knowledge (16.8 average years of schooling) and service (11.3 average years of schooling) occupations is associated with an average premium in earnings of 30 per cent for those in knowledge occupations.

Table 6. Between and within occupational effects of years of schooling on weekly log-earnings, adjusted^a, model 2

	Maximum likelihood HLM coefficients	s.e.	t-value	Returns to an additional year of schooling (%)
Constant-G0				
Intercept-G00	6.068134 ***	(.0646)	93.88	
Average years of schooling (between effect)	0.055023 ***	(.0093)	5.89	5.5
Years of schooling-G2				
Intercept-G20 (average within effect)	0.039035 ***	(.0084)	4.66	3.9
Years of schooling-G2 (within effects by occupation)				
Intercept-G00 (other goods=reference group)	0.02121 *	(.0101)	2.10	2.1
Change to reference group^b				
Knowledge	0.02634	(.0162)	2.93	4.8
Management	-0.00256	(.0140)	1.34	1.9
Data	0.00705	(.0115)	2.47	2.8
Data manipulation	0.01411	(.0139)	2.54	3.5
Service	0.06876 **	(.0217)	4.15	9.0
Skilled goods	0.02430	(.0175)	2.60	4.6

Source: Canadian Adult Literacy Survey (1994).

Notes:

* p < .05

** p < .01

*** p < .001

a. Results are adjusted for literacy proficiency, log-labour force experience and gender.

b. Significance estimates that are reported by occupational types are based on a t-test of the statistical difference to the parameter from the reference group, namely 'other goods' occupations. For this reason, t-values based on the standard t-test of the statistical difference to zero are reported separately. Otherwise, all significance estimates are based on the standard t-test of the statistical difference to zero

The fixed effect of years of schooling on earnings suggests that within occupations there are on average 3.9 per cent more earnings associated with each additional year of schooling. On the other hand, more schooling may also allow someone to enter occupational types, which pay premiums (i.e., well paying occupations), on the order of 5.5 per cent per additional year of schooling.

Moreover, the within effect varies considerably by occupational type. Model 2B reports the precise within occupational effects of schooling on earnings. The reference group is 'other goods' occupations. For example, the within effect for

‘other goods’ occupations is approximately 2.1 per cent, but it is nearly 4.7 per cent for knowledge occupations. Except for management type occupations, all within effects are statistically significant. Only in service occupations, however, do the results show that education has a significantly stronger effect than in ‘other goods’ occupations. See Obserg (1989) for findings about the economic return to educational attainment by aggregated occupational types.

5.3 *Literacy skill premium*

Model 3 shows that considering the difference in average literacy proficiency scores between occupational types explains more than two thirds, approximately 70 per cent, of the variation in earnings occurring between occupations. But because years of schooling and literacy proficiency are highly correlated, especially at an aggregated level of analysis, both factors are not simultaneously significant at the between level of analysis. Thus one can only compare the variance explained by schooling or literacy proficiency at the between level in separate analyses. Results in Table 3B indicate that differences in average literacy proficiency capture six per cent more of the variation in earnings than differences in average years of schooling.

The findings suggest that for every 10-point increase in the average level of literacy proficiency at the occupational level, there is an associated 5 per cent increase in weekly log-earnings. For example, on the basis of an observed 80-point difference on the IALS literacy scale between those in knowledge and other goods occupations, knowledge workers earn on average 40 per cent more than other goods workers.

Unlike years of schooling, the results suggest that the average within occupational effect of literacy proficiency on earnings is not statistically significant at the 5 per cent level (t -value=1.88). But this depends on the type of occupation. Model 3B suggests that the within occupation effect is only significant for management and other goods occupations. The within effects are smaller for data occupations, and yet smaller for services and skilled goods occupations, producing insignificant results. Although not significant, the effect of literacy proficiency on earnings within data manipulation occupations is slightly negative.

Within management occupations the return to literacy proficiency are estimated at approximately 1.7 per cent for every 10-point increase on the IALS literacy scale. Knowledge and other goods occupations do not statistically differ

Table 7. Between and within occupational effects of literacy proficiency on weekly log-earnings, adjusted^a, model 3

	Maximum likelihood HLM coefficients	s.e.	t-value	Returns to an additional 10-points in literacy (%)	Returns to an additional standard deviation in literacy ^c (%)
Constant-G0					
Intercept-G00	6.067711 ***	(.0590)	102.87		
Average literacy proficiency (between effect)	0.005022 ***	(.0015)	3.28	5.0	32.6
Literacy proficiency-G1					
Intercept-G10 (average within effect)	0.00069	(.0004)	1.88	0.7	4.5
Literacy proficiency-G1 (within effects by occupation)					
Intercept-G00 (other goods=reference group)	0.00206 ***	(.0004)	5.11	2.1	13.4
Change to reference group^b					
Knowledge	-0.00117	(.0009)	0.95	0.9	5.8
Management	-0.00034	(.0008)	2.21	1.7	11.2
Data	-0.00165 ***	(.0005)	0.79	0.4	2.7
Data manipulation	-0.00260 ***	(.0006)	-0.91	-0.5	-3.5
Service	-0.00187 **	(.0009)	0.20	0.2	1.2
Skilled goods	-0.00170 **	(.0007)	0.51	0.4	2.3

Source: Canadian Adult Literacy Survey (1994).

Notes:

- * p < .05
- ** p < .01
- *** p < .001

- a. Results are adjusted for years of schooling, log-labour force experience and gender.
- b. Significance estimates that are reported by occupational types are based on a t-test of the statistical difference to the parameter from the reference group, namely 'other goods' occupations. For this reason, t-values based on the standard t-test of the statistical difference to zero are reported separately. Otherwise, all significance estimates are based on the standard t-test of the statistical difference to zero.
- c. The average standard deviation for all occupations is approximately 59-points on a scale from 0 to 500 points.

from management occupations, but because the former varies significantly, it is also not statistically different from zero. For data occupations, the return lowers to approximately 0.4 per cent for every 10-point increase on the IALS literacy scale, and down to approximately 0.2 and 0.4 per cent respectively for services and skilled goods occupations, which are also insignificant results. Alternate calculations using percentile IALS scores, which allows for non-linearity in the literacy proficiency scale, do not significantly vary and are thus not reported here.

6. Key findings and discussion

6.1 Summary of key findings

1. There are observed occupational premiums even after adjusting for within occupational differences in individual characteristics such as schooling, literacy proficiency, labour force experience and gender. This suggests that there are systematic differences in characteristics at the occupational level that can explain observed differences in individual earnings. Moreover, it suggests that there are well paying occupations.
2. The between occupational effect of schooling on earnings explains 64 per cent of the variation in occupational premiums. This indicates that the average years of schooling of those working in different occupational types significantly affects earnings. In other words, those with more years of schooling tend to benefit from the occupational premiums that are associated with well paying occupations.
3. Similarly, the between occupational effect of literacy proficiency on earnings explains 70 per cent of observed occupational premiums. This indicates that the average level of literacy proficiency of those working in different occupational types significantly affects earnings. In other words, those with higher literacy proficiency tend to benefit from the occupational premiums that are associated with well paying occupations.
4. The between occupational effects of schooling and literacy proficiency are not jointly significant, because they are highly correlated at the occupational level. By extension this implies that at the occupational level only one of these characteristics is necessary to explain approximately two-thirds of observed differences in individual earnings between occupations. Literacy proficiency appears to be a better predictor, however, since it explains six per cent more of the between occupational variation in earnings.
5. The within occupational effect of schooling on earnings is on average significant, but it also varies significantly among the occupational types. Consequently, in some occupational types years of schooling is a more relevant factor in terms of explaining differences in earnings than in other types of occupations.

6. In contrast, while the within occupational effect of literacy proficiency on earnings is significant for some occupational types, it is not on average. This means that in some occupations those with higher literacy proficiency are not necessarily earning more than those who share the same type of occupation but have lower literacy proficiency. Only within management and 'other goods' occupations does observed literacy proficiency have a significant effect on earnings within those occupations.
7. The fact that the within occupational effect of schooling is significant in some occupations while at the same time the effect of literacy proficiency is not suggests that an indirect measure of human capital (years of schooling) is a more important predictor of earnings than a direct measure of human capital (literacy proficiency) in those occupations. On the other hand, both measures are important predictors in two occupational types, namely 'other goods' and 'management' type occupations.

6.2 Discussion

This study cannot determine with any certainty whether the occupational premiums that are observed arise because individuals in those occupational types are more productive and hence contribute more to the final value of production. There are many other factors or characteristics at the occupational level, which are not considered here and may explain the observed premiums. Keeping with the theoretical perspective discussed above, however, two separate measures of human capital are considered as potential factors that can account for these occupational premiums.

Indeed, an indirect measure of human capital, namely years of schooling, is found to account for nearly two-thirds of the occupational premiums. The same is true for a direct measure of human capital, namely literacy proficiency. One or the other, however, is sufficient at the occupational level since they are highly correlated. But the direct measure fits the observed data better by capturing six per cent more of the variation in earnings at the occupational level. This is not surprising since the IALS literacy proficiency measure captures some of the depreciation or appreciation of skills that can occur after schooling. When allocating jobs and pay, employers rely on prior experience and other factors beyond schooling to successfully infer the skill profiles of individuals. The extent to which employers are successful at doing this within occupational types, however, is a different matter since individual characteristics tend to cluster in different types of occupation (see standard deviations in Table 2).

This makes it more difficult for employers to precisely differentiate skill profiles within occupational types.

Human capital is multi-faceted. So which human capital are these measures indicating: cognitive skills, leadership skills, communication skills, fine or gross motor skills, etc...? Among the skills listed, the IALS literacy proficiency measure relates closely to cognitive skills, whereas years of schooling may indicate a broader range of skill types. Even further, cognitive skills are also multi-faceted where literacy proficiency is only one element, albeit a very important one (i.e., foundation skills), among others such as problem solving, planning, understanding of abstract concepts, etc...

The method used in this study to derive the seven aggregated occupational types is based on five indices representing broad skill types that are deemed required to carry out the occupational tasks of different occupations. These are cognitive skills, authority-management skills, communication skills, fine motor and gross motor skills. Table 8 indicates that substantial premiums are observed for occupations that require cognitive, authority-management, and communication skills the most. For example, management occupations tend to require all three of these skills comparatively more than other occupations and also tend to pay the highest premiums. Moreover, the three occupational types requiring cognitive skills the most, namely 'knowledge', 'data' and 'management' occupations display the highest premiums. This suggests that cognitive skills are significantly rewarded on the labour market.

Individuals with higher levels of individual literacy proficiency as well as more years of schooling, on average tend to cluster in these latter occupations (see Table 2). Since literacy proficiency is a good indicator of cognitive skills, this result suggests that on average there is a good match between the observed skills of individuals and the skill requirements of the occupations they work in.

Moreover, the findings suggest that the reward to literacy proficiency depends on the extent of the relevance of cognitive skills at the occupational level. The same can be said for the return to years of schooling. But the latter is problematic since it does not inform on the type of human capital, and hence the differential effect (or relevance) of different skills on earnings in different occupations. For example, vocational schooling may emphasize the formation of fine and gross motor skills, whereas academic style schooling may emphasize the formation of cognitive skills. The relevance of either will depend on the type of occupation one is employed in. In this analysis the type of schooling is not controlled for.

Most of the return to literacy proficiency is observed between occupational types. Within occupational types, those with more literacy proficiency are not necessarily earning more than those with lower literacy proficiency. This latter

Table 8. Standardized scores of required broad skill types by occupational types

Occupational types	Occupational premium ^{1,a} (%)	Standardized scores of required broad skill types ²				
		Cognitive skills	Authority - management skills	Communication skills	Fine motor skills	Gross motor skills
Management	36	1.75	1.66	1.35	-0.34	-0.11
Data	29	1.23	0.81	0.70	0.32	0.02
Knowledge	21	2.12	1.03	0.78	0.85	0.08
Skilled goods	16	0.44	0.57	0.12	0.10	0.25
Data manipulation	3	0.11	0.08	0.30	-0.46	-0.44
Service	-34	-0.60	-0.32	0.05	-0.37	-0.07
Other goods	--	-1.06	-0.86	-0.73	-0.04	0.00

Occupational types are ranked in descending order according to the occupational premiums.

Sources:

1. Canadian Adult Literacy Survey (1994).

2. Béjaoui (2000).

Notes:

a. Occupational premiums calculated as a percentage relative to the expected weekly log-earnings of 'other goods' occupations.

result depends on the type of occupation. Surprisingly, the within occupational effect of literacy proficiency on earnings is highest in 'other goods' occupations where cognitive skills are the least relevant. In occupations where cognitive skills are the most relevant, the within effect is relatively weak, except for 'management' type occupations.

In contrast, the between and within occupational effect of schooling is significant in all types, although it varies. Interestingly, the two occupations where the within effects of schooling are lowest, are also where the within effects of literacy are highest. This shows that for some types of occupations, a direct measure of human capital explains differences in earnings beyond what an indirect measure can explain. While literacy proficiency is more difficult for employers to observe than years of schooling, it appears that in some occupational types, pay is partly allocated on the basis of these skills being observed.

Table 2 shows that those in 'other goods' occupations have the highest variation of both literacy proficiency and years of schooling, which indicates that there is less clustering of those characteristics within this type of occupation. This makes selection on the basis of skills that are difficult to observe easier. In contrast, those in 'management', 'data' and 'knowledge' occupations have the least variation in literacy proficiency, which indicates a

high clustering of those characteristics in those occupations. This makes selection on the basis of skills more difficult. But interestingly while those in ‘management’ occupations display the lowest variation in literacy proficiency, they also display the highest variation in years of schooling. These findings suggest that managers’ skill profiles are scrutinized more than in any other occupation, at least from what can be inferred beyond years of schooling (i.e., validated qualifications).

7. Concluding remark

In occupations where the within effect of skills on earnings is weak, one of two things or a combination thereof may be implied: (a) literacy skills are weakly related to productivity and hence earnings, or (b) employers have difficulty observing and hence selecting on the basis of differences in literacy skills independent of other validated qualifications.

Unlike years of schooling, which act as validated qualifications, literacy skills are not easily observed and hence validated. In fact, they are probably inferred from years of schooling, which is indeed a good predictor of literacy proficiency (Boudard, 2001). What happens outside and beyond schooling also affects skills, however. Without the proper validation of skills it is difficult for employers to infer actual skill profiles. As a result of poor information, employers may have difficulties matching actual skills of employees with job tasks. Instead they are forced to rely on validated qualifications. In short, validation systems of knowledge and skills are likely to have a pervasive impact on the distribution of earnings.

Appendix A. Classification of occupational types

A. Knowledge	B. Management (cont'd)
1171 Accountants, auditors & other financial officers 1173 Organization and methods analysts 2111 Chemists 2112 Geologists 2113 Physicists 2114 Meteorologists 2131 Agriculturalists & related scientists 2133 Biologists and related scientists 2141 Architects 2142 Chemical Engineers 2143 Civil engineers 2144 Electrical engineers 2145 Industrial engineers 2146 Agricultural Engineers 2147 Mechanical engineers 2151 Metallurgical Engineers 2153 Mining Engineers 2154 Petroleum Engineers 2155 Aerospace engineers 2156 Nuclear Engineers 2157 Community planners 2159 Professional engineers, nec 2181 Mathematicians, statisticians & actuaries 2311 Economists 2313 Sociologists, Anthropologists and Related 2315 Psychologists 2319 Others in social sciences, nec 2341 Judges and Magistrates 2343 Lawyers & notaries 2351 Librarians, Archivists and Conservators 2711 University teachers 3111 Physicians & surgeons 3113 Dentists 3311 Painters, sculptors & related artists 3331 Conductors, Composers and Arrangers 3332 Musicians and Singers 3351 Writers & editors	1141 Purchasing management 1142 Services management 1143 Production management 1145 Management, constructing operations 1146 Farm management 1147 Management, transport and communications operations 1149 Other managers and administrators 2350 Supervisors: Occupations In Library, 3330 Producers & directors, performing & audio-visual arts 5130 Supervisors: Sales, commodities 5170 Supervisor: Sales, services
B. Management	C. Data
1111 Members of Legislative Bodies 1113 Government administrators 1115 Post office management occupations 1119 Officials and administrators unique to government 1130 General managers and other senior officials 1131 Management occupations, natural sciences and eng. 1132 Management occupations, social sciences and related 1133 Administrators in teaching and related fields 1134 Administrators in health and medicine 1135 Financial management occupations 1136 Personnel and industrial relations management 1137 Sales and advertising management	1116 Inspectors & regulatory officers, government 1174 Personnel and related officers 1175 Purchasing officers & buyers 1176 Inspectors and regulatory officers, nec 1179 Other related to management and administration 2117 Physical sciences technologists & technicians 2119 Occupations In Physical Sciences, n.e.c. 2135 Life sciences technologists & technicians 2139 Other occupations in life sciences, nec 2160 Supervisors: Other Occupations In archit. And engineering 2161 Surveyors 2163 Draughting 2164 Architectural Technologists and Technicians 2165 Engineering technologists & technicians 2169 Others in engineering or architecture, nec 2183 Systems analysts, computer programmers & other related 2189 Occupations In Mathematics, Statistics, 2331 Social workers 2333 Welfare & community services 2339 Social work & related fields, nec 2359 Occupations In Library, Museum and Archival 2719 University teaching & related, nec 2731 Elementary & kindergarten teachers 2733 Secondary school teachers 2739 Elementary & secondary school teaching & related, nec 2791 Community college & vocational school teachers 2792 Fine Arts Teachers, n.e.c. 2793 Post-secondary school teachers, nec 2795 Teachers of exceptional students, nec 2797 Instructors & training officers, nec 2799 Other teaching & related, nec 3115 Veterinarians 3117 Osteopaths and Chiropractors 3119 Health Diagnosing and Treating Occupations, 3130 Supervisors: Nursing, therapy and related assisting 3131 Nurses, registered 3136 Audio and Speech Therapists 3137 Physiotherapist

C. Data (cont'd)	D. Data manipulation (cont'd)
3138 Occupational therapist	4160 Supervisors: Library, File and
3151 Pharmacists	4161 Library & file clerks
3152 Dieticians & nutritionists	4169 Library, file & correspondence clerks & related, nec
3153 Optometrists	4170 Supervisors: Reception, information, mail & message dist.
3155 Radiological technologists & technicians	4171 Receptionists & information clerks
3156 Medical laboratory technologists & technicians	4173 Mail & postal clerks
3169 Others in medicine & health, nec	4179 Supervisors: Reception, information, mail & message dist.
3313 Product & interior designers	4190 Supervisors: Other clerical and related, nec
3314 Advertising & illustrating artists	4191 Collectors
3333 Occupations Related To Music and Musical	4192 Claim adjusters
3334 Dancers and Choreographers	4193 Travel clerks, ticket, station and freight agents
3335 Actors	4195 Personnel Clerks
3337 Radio & television announcers	4197 General office clerks
3355 Translators & interpreters	4199 Other clerical and related, nec
3359 Occupations In Writing, n.e.c.	5133 Commercial travellers
3360 Supervisors: Sports & recreation	5135 Sales clerks & persons, commodities, nec
3370 Coaches, Trainers and Instructors, Sports	5171 Insurance sales
3371 Referees and Related Officials	5172 Real estate sales
3373 Athletes	5173 Sales Agents and Traders, Securities
3375 Coaches, trainers & instructors, sports & recreation	5174 Advertising sales
5131 Technical sales and related advisors	5177 Business services sales
5191 Buyers, wholesale & retail trade	5179 Sales, services, nec
6116 Commissioned Officers, Armed Forces	5190 Supervisors: other sales
6141 Funeral directors, embalmers and related	5199 Other sales, nec
6141 Funeral Directors, Embalmers and Related	9135 Railway transport operating support
9110 Foremen/women: Air Transport Operating	9553 Telegraph operators
9111 Air pilots, navigators & flight engineers	
9113 Air transport operating support	
9151 Deck officers	
D. Data manipulation	E. Services
2349 Law & jurisprudence, nec	2519 Religion, nec
2391 Educational & vocational counsellors	3132 Orderlies
2399 Social sciences & related fields, nec	3134 Nurses, registered assistants
2511 Ministers of religion	3135 Nursing attendants
4110 Supervisors: Stenographic and Typing	3139 Nursing, therapy & related assisting
4111 Secretaries & stenographers	3158 Dental hygienists & assistants
4113 Typists & clerk-typists	3162 Respiratory technicians
4130 Supervisors: Bookkeeping, account-recording & related	3339 Others in performing & visual arts, nec
4131 Bookkeepers & accounting clerks	4172 Mail carriers
4133 Cashiers & tellers	4175 Telephone operators
4135 Insurance, bank & other finance clerks	4194 Hotel clerks
4137 Statistical Clerks	5141 Street vendors & door-to-door sales
4139 Bookkeeping, Account-recording and Related	5145 Service station attendants
4140 Supervisors: Office Machine and Electronic	5149 Sales, commodities, nec
4141 Office machine operators	5193 Route drivers
4150 Supervisors: Material recording, scheduling & dist.	6111 Fire-fighter
4151 Production clerks	6112 Police officer & detective
4153 Shipping & receiving clerks	6115 Guards & related security
4155 Stock clerks & related	6117 Other ranks, armed forces
4157 Weighers	6119 Protective services, nec
4159 Material Recording, Scheduling and	6120 Supervisors: Food & beverage preparation & related
	6123 Bartenders
	6125 Food & beverage serving
	6129 Food & beverage preparation & related, nec

E. Services (Cont'd)	F. Skilled goods (cont'd)
6130 Supervisors: Lodging & other accomodation 6133 Lodging cleaners 6142 Housekeepers, servants & related 6143 Barbers, hairdressers and related 6147 Guides 6149 Personal service, nec 6190 Supervisors: other service 6191 Janitors & cleaners 6193 Elevator operators 6198 Labour & other elementary, services 6199 Other services, nec 9133 Conductors & brake operators, railway 9171 Bus drivers 9173 Taxi drivers & chauffers 2513 Nuns and Brothers 3379 Occupations In Sports and Recreation, n.e.c. 4177 Messengers 5143 Newspaper Carriers and Vendors 6113 Police Agents and Investigators, Private 6135 Sleeping-car and Baggage Porters 6139 Occupations In Lodging and Other 6144 Guides 6145 Travel and Related Attendants, Except 9119 Air Transport Operating Occupations, n.e.c. 9191 Subway and Street Railway Operating 9919 Other Occupations, n.e.c.	8553 Fabricating & assembling 8580 Fabricating & assembling 8584 Fabricating & assembling 8585 Fabricating & assembling 8588 Fabricating & assembling 8590 Fabricating & assembling 8710 Construction 8730 Construction 8731 Construction 8733 Construction 8735 Construction 8739 Construction 8780 Construction 8781 Construction 8784 Construction 8791 Construction 8795 Construction 9159 Engineering officers, ship 9170 Foremen: Motor transport operating 9190 Foremen: Other transport equip. Operating 9310 Foremen: Material handling & related, nec 9510 Formen: Printing & related 9511 Typesetting & composing 9512 Printing press 9559 Other electronic & related communications 3154 Dispensing Opticians 3157 Denturists
F. Skilled goods	
2353 Technicians in library, museum and achival sciences 7113 Livestock farmer 7115 Crop farmer 7119 Farmer, nec 7180 Foremen: Other farming, horticultural & animal husbandry 7311 Captains & other officers, fishing 7510 Foremen: forestry & logging 7710 Foremen: Mining & quarrying 8130 Processing 8160 Processing 8230 Processing 8250 Processing 8290 Foremen/women: Other Processing 8310 Machining 8311 Machining 8313 Machining 8330 Machining 8333 Machining 8337 Machining 8510 Fabricating & assembling 8533 Fabricating & assembling 8535 Fabricating & assembling 8537 Fabricating & assembling	3161 Dental Laboratory Technicians 3315 Photographers and Camera Operators 3319 Occupations In Fine and Commercial Art, 7315 Trapping and Related Occupations 8110 Foremen/women: Mineral Ore Treating 8150 Foremen/women: Clay, Glass and Stone 8210 Foremen/women: Food, Beverage and Related 8260 Foremen/women: Textile Processing 8316 Inspecting, Testing, Grading and Sampling 8350 Foremen/women: Wood Machining Occupations 8351 Wood Patternmaking Occupations 8370 Foremen/women: Clay, Glass, Stone and 8390 Foremen/women: Other Machining and Related 8395 Patternmakers and Mouldmakers, n.e.c. 8399 Other Machining and Related Occupations, 8515 Aircraft Fabricating and Assembling 8530 Foremen/women: Fabricating, Assembling, 8540 Foremen/women: Fabricating, Assembling and 8546 Inspecting, Testing, Grading and Sampling 8550 Foremen/women: Fabricating, Assembling 8555 Furriers 8570 Foremen/women: Fabricating, Assembling and 8582 Aircraft Mechanics and Repairers 8583 Rail Transport Equipment Mechanics and

F. Skilled goods (cont'd)	G. Other goods (cont'd)
8736 Inspecting, Testing, Grading and Sampling 8796 Inspecting, Testing, Grading and Sampling 9130 Foremen/women: Railway Transport Operating 9131 Locomotive Operating Occupations 9153 Engineering Officers, Ship 9513 Stereotyping and Electrotyping Occupations 9514 Printing Engraving, Except Photoengraving, 9515 Photoengraving 9530 Foremen/women: Stationary Engine and 9531 Power Station Operators 9550 Foremen/women: Electronic and Related 9551 Radio and Television Broadcasting Equipment 9555 Sound and Video Recording and Reproduction 9557 Motion Picture Projectionists 9590 Foremen/women: Other Crafts and Equipment 9910 Supervisors and Foremen/women, n.e.c.	8133 Metal Heat-treating Occupations 8135 Metal Rolling Occupations 8137 Moulding, Coremaking and Metal Casting 8141 Metal Extruding and Drawing Occupations 8143 Plating, Metal Spraying and Related 8146 Inspecting, Testing, Grading and Sampling 8148 Processing 8149 Processing 8151 Furnace and Kiln Workers: Clay, Glass and 8153 Processing 8155 Processing 8156 Inspecting, Testing, Grading and Sampling 8158 Occupations In Labouring and Other 8159 Clay, Glass and Stone Processing, Forming 8161 Mixing and Blending Occupations, Chemicals 8163 Filtering, Straining and Separating 8165 Processing 8167 Roasting, Cooking and Drying Occupations, 8171 Crushing and Grinding Occupations, 8173 Coating and Calendering Occupations, 8176 Inspecting, Testing, Grading and Sampling 8178 Occupations In Labouring and Other Elemental 8179 Processing 8211 Flour and Grain Milling Occupations 8213 Processing 8215 Processing 8217 Processing 8221 Fruit and Vegetable Canning, Preserving 8223 Processing 8225 Sugar Processing and Related Occupations 8226 Processing 8227 Beverage Processing and Related Occupations 8228 Processing 8229 Processing 8231 Processing 8233 Processing 8235 Wood Treating Occupations 8236 Processing 8238 Processing 8239 Processing 8251 Processing 8253 Processing 8256 Inspecting, Testing, Grading and Sampling 8258 Processing 8259 Processing 8261 Processing 8263 Textile Spinning and Twisting Occupations 8265 Textile Winding and Reeling Occupations 8267 Processing 8271 Knitting Occupations 8273 Textile Bleaching and Dyeing Occupations
G. Other goods	
4143 Electronic data-processing equipment operators 6121 Chefs & cooks 6160 Supervisors: Apparel and Furnishings 6162 Laundering & dry cleaning 6165 Pressing Occupations 6169 Apparel and Furnishings Service 7183 Livestock farm workers 7185 Crop farm workers 7195 Nursery & related workers 7196 Inspecting, Testing, Grading and Sampling 7197 Farm machinery operators 7199 Other farming, nec 7313 Net, trap & line fishing 7319 Fishing, Trapping and Related Occupations, 7511 Forestry cinservation 7513 Timber cutting & related 7516 Log inspecting, grading, sclaing & related 7517 Log hoisting, sorting, moving & related 7518 Occupations In Labouring and Other 7519 Forestry & logging 7711 Well drilling & related 7713 Rock & soil drilling 7715 Blasting 7717 Mining & quarrying: cutting, handling & loading 7718 Labouring & other elementary, mining & quarrying & related 7719 Mining & quarrying & related, nec 8111 Crushing and Grinding Occupations, Mineral 8113 Mixing, Separating, Filtering and Related 8115 Melting and Roasting Occupations, Mineral 8116 Processing 8118 Processing 8119 Processing 8131 Processing	

G. Other goods (cont'd)	G. Other goods (cont'd)
8275 Textile Finishing and Calendering	8569 Fabricating & assembling
8276 Inspecting, Testing, Grading and Sampling	8571 Fabricating & assembling
8278 Occupations In Labouring and Other	8573 Moulding Occupations: Rubber, Plastic and
8279 Processing	8575 Cutting and Finishing Occupations: Rubber,
8293 Processing	8576 Inspecting, Testing, Grading and Sampling
8295 Hide and Pelt Processing Occupations	8578 Occupations In Labouring and Other Elemental
8296 Inspecting, Testing, Grading and Sampling	8579 Fabricating & assembling
8298 Occupations In Labouring and Other	8581 Fabricating & assembling
8299 Other Processing Occupations, n.e.c.	8586 Inspecting, Testing, Grading and Sampling
8315 Machining	8587 Watch and Clock Repairers
8319 Metal Machining Occupations, n.e.c.	8589 Fabricating & assembling
8331 Machining	8591 Jewellery and Silverware Fabricating,
8334 Machining	8592 Fabricating & assembling
8335 Machining	8593 Fabricating & assembling
8336 Inspecting, Testing, Grading and Sampling	8595 Fabricating & assembling
8339 Machining	8596 Inspecting, Testing, Grading and Sampling
8353 Wood Sawing and Related Occupations, n.e.c.	8598 Fabricating & assembling
8355 Planing, Turning, Shaping and Related Wood	8599 Fabricating & assembling
8356 Inspecting, Testing, Grading and Sampling	8711 Construction
8357 Wood Sanding Occupations	8713 Construction
8359 Wood Machining Occupations, n.e.c.	8715 Construction
8371 Cutting and Shaping Occupations: Clay,	8718 Construction
8373 Machining	8719 Excavating, grading, paving
8376 Inspecting, Testing, Grading and Sampling	8738 Occupations In Labouring and Other
8379 Machining	8782 Construction
8391 Engravers, Etchers and Related Occupations,	8783 Concrete Finishing and Related Occupations
8393 Machining	8785 Construction
8396 Inspecting, Testing, Grading and Sampling	8786 Construction
8511 Engine and Related Equipment Fabricating	8787 Construction
8513 Fabricating & assembling	9139 Railway Transport Operating Occupations,
8523 Fabricating & assembling	9155 Deck Crew, Ship
8525 Business and Commercial Machines Fabricating	9157 Engine and Boiler-room Crew, Ship
8526 Fabricating & assembling	9175 Truck drivers
8527 Precision Instruments and Related	9179 Motor transport operating, nec
8528 Fabricating & assembling	9193 Rail Vehicle Operators, Except Rail
8529 Fabricating & assembling	9199 Other transport equip. Operating, nec
8531 Fabricating & assembling	9311 Hoisting, nec
8534 Fabricating & assembling	9313 Longshore workers & freight handlers
8536 Inspecting, Testing, Grading and Sampling	9314 Parcel Carriers, n.e.c.
8538 Occupations In Labouring and Other	9315 Material handling equipment operators, nec
8539 Fabricating & assembling	9317 Packaging occupations
8541 Fabricating & assembling	9318 Labouring, other elementary, material handling & related, nec
8548 Occupations In Labouring and Other	9319 Other Material Handling and Related
8549 Fabricating & assembling	9517 Bookbinding & related
8551 Patternmaking, Marking and Cutting	9518 Occupations In Labouring and Other Elemental
8557 Milliners, Hat and Cap Makers	9519 Printing & related, nec
8561 Fabricating & assembling	9539 Stationary engine & utilities equip operating & related
8562 Fabricating & assembling	9591 Photographic processing
8563 Fabricating & assembling	9599 Other Crafts and Equipment Operating
8566 Inspecting, Testing, Grading and Sampling	9916 Inspecting, Testing, Grading and Sampling
8568 Occupations In Labouring and Other Elemental	9918 Occupations In Labouring and Other

Source: Adapted from Boothby (1999) and Béjaoui (2000).

Notes: not elsewhere classified (nec).

References

- Arrow, K.J. (1973). Higher education as a filter. *Journal of Public Economics*, 2, 193-216.
- 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* (Editions revised in 1975 and 1993). Chicago: University of Chicago Press.
- 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 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.
- Boothby, D. (1999). 'Literacy skills, the knowledge content of occupations and occupational mismatch'. Working Paper 99-3E, Hull, Quebec, Applied Research Branch, Human Resource Development Canada.
- Boudard, E. (2001). *Literacy Proficiency, Earnings and Recurrent Training: A Ten Country Comparative Study*. Stockholm: Institute of International Education.
- Bryk, A.S., & Raudenbush, S.W. (1992). *Hierarchical Linear Models: Applications and Data Analysis Methods*. London: Sage Publications.
- Béjaoui, A. (2000). *L'évolution de la prime associée aux qualifications et son implication quant aux changements de la structures des salaires*. Montréal: Université de Montréal.
- Card, D. (1999). The causal effect of education on earnings. In: O. Ashenfelter & D. Card (eds), *Handbook of Labour Economics* (pp. 1801-1863). Oxford: Elsevier Science.
- Devroye, D., & Freeman, R. (2001). 'Does inequality in skill explain inequality of earnings across advanced countries'. Working Paper 8140, Cambridge, MA, National Bureau of Economic Research.
- Doeringer, P., & Piore, M. (1971). *Internal Labour Markets and Manpower Analysis*. Lexington, MA: Lexington Books.
- 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.
- Green, D.A., & Riddell, W.C. (2001). *Literacy, Numeracy and Labour Market Outcomes in Canada*. Ottawa and Hull: Statistics Canada and Human Resource Development Canada.
- HRDC (2001, October 12). Readers' guide to essential skills profiles, Skills Information Division, Human Resource Development Canada, Hull, Quebec. Retrieved from http://www15.hrdc-drhc.gc.ca/english/readers_guide_whole.asp.

- Lavoie, M., & Roy, R. (1998). 'Employment in the knowledge-based economy: A growth accounting exercise for Canada'. Research Paper, Hull, Quebec, Applied Research Branch, Human Resources Development Canada.
- Leuven, E. (2001). *Studies in the Economics of Training*. Amsterdam: Universiteit van Amsterdam.
- Massé, P., Roy, R., & Gingras, Y. (2000). The changing skill structure of employment in Canada. In: K. Rubenson & H.G. Schuetze (eds), *Transition to the Knowledge Society: Policies and Strategies for Individual Participation and Learning*. Vancouver, BC: British Columbia Press.
- Mincer, J. (1958). Investment in human capital and personal income distribution. *Journal of Political Economy*, 66(4), 281-302.
- Mincer, J. (1962). On-the-job training: Costs, returns, and some implications. *Journal of Political Economy*, 70(5-2), 50-79.
- Mincer, J. (1974). *Schooling, Experience, and Earnings*. New York: Columbia University Press.
- Murnane, R.J., Willet, J.B. and 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., Kirsch, I.S., & Jenkins, L.B. (1998). *Adult Literacy in OECD Countries: Technical Report on the First International Adult Literacy Survey*. Washington, DC: National Centre for Education Statistics.
- OECD (2001). *Education Policy Analysis*. Paris: Author.
- OECD & HRDC (1997). *Literacy Skills for the Knowledge Society: Further Results from the International Adult Literacy Survey*. Paris and Ottawa: Authors.
- OECD & Statistics Canada (2000). *Literacy in the Information Age: Final Report of the International Adult Literacy Survey*. Paris and Ottawa: Authors.
- Osberg, L. (1989). Paying information workers. In L. Osberg, E.N. Wolff, & W.J. Baumol, *The Information Economy: The Implications of Unbalanced Growth* (pp. 47-86). Halifax: Institute for Research on Public Policy.
- Osberg, L. (2000). *Schooling, Literacy and Individual Earnings*. Ottawa and Hull: Statistics Canada and Human Resource Development Canada.
- Osberg, L., Wolff, E.N., & Baumol, W.J. (1989). *The Information Economy: The Implications of Unbalanced Growth*. Halifax: Institute for Research on Public Policy.
- Raudenbush, S.W., & Kasim, R.M. (1998). Cognitive skill and economic inequality: Findings from the national adult literacy survey. *Harvard Educational Review*, 68(1), 33-79.
- Raudenbush, S.W., & Kasim, R.M. (2002). *Adult Literacy, Social Inequality, and the Information Economy: Findings from the National Adult Literacy Survey*. Ottawa and Hull: 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.
- Spence, A.M. (1973). Job market signalling. *Quarterly Journal of Economics*, 87(3), 355-374.
- Stigler, G. (1961). The economics of information. *Journal of Political Economy*, 69, 213-225.
- Schultz, T.W. (1961). Investment in human capital. *American Economic Review*, 51(1), 1-17.
- Schultz, T.W. (1975). The value of the ability to deal with disequilibria. *Journal of Economic Literature*, 13(3), 827-846.
- Stern, D., & Tuijnman, A.C. (1997). Adult basic skills: Policy issues and a research agenda. In A.C. Tuijnman, I.S. Kirsch & D.A. Wagner (eds), *Adult Basic Skills: Innovations in Measurement and Policy Analysis* (pp. 1-16). New Jersey: Hampton Press.
- Tuijnman, A.C. (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, Second Edition* (pp. 230-234). Oxford: Pergamon Press.
- Weiss, A. (1995). Human capital vs. signalling explanations of wages. *Journal of Economic Perspectives*, 9(4), 133-154.
- Wolff, E.N., & Baumol, W.J. (1989). Sources of postwar growth of information activity in the United States. In L. Osberg, E.N. Wolff, & W.J. Baumol, *The Information Economy: The Implications of Unbalanced Growth* (pp. 17-46). Halifax: Institute for Research on Public Policy.

The Effects of Learning on Economic and Social Well-Being: A Comparative Analysis

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Drawing on the changing view and attitude toward the concept of human capital in recent years, this article empirically investigates the broad effects of learning. Using the structural model presented in Desjardins (in press), hypotheses are comparatively examined using the International Adult Literacy Survey data for Canada, Denmark, The Netherlands, Norway, the United Kingdom, and the United States. The model acknowledges all potential sources of knowledge and skills relevant to economic as well as social well-being by constructing indicators spanning the entire spectrum of life-wide learning. Moreover, learning undertaken for job-related reasons and personal-interest reasons are examined separately to identify heterogeneity in the effects of learning for different reasons. The model is constructed on the premise that initial schooling has profound effects on adults' readiness to learn in their productive years and that this is the mechanism that will affect their well-being. Only the adult populations aged 25 to 55 are considered, in which initial schooling is taken as a stock measure of initial formal learning that has already occurred. The extent of how the stock of initial formal learning affects the flow of subsequent learning and in turn the flow of well-being is examined.

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Learning is increasingly acknowledged as being a fundamental aspect of human living (Delors, 1996). People need to learn for the purposes of continuously adapting to and coping with their surroundings. This is a necessity not only for survival, but also for one's increased well-being in all spheres of human life, including the personal, social, and economic spheres. The increasing awareness about the broad effects of learning is underscored by the definition of *human capital* used in the Organization for Economic Cooperation and Development (OECD, 2001) report *The Well-Being of Nations*: "The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being" (OECD, 2001, p. 18).

Conventionally, the human capital research literature has mostly been concerned with the economic effects of learning. However, there is an increasing awareness that the economic effects of learning are interrelated with the personal and social effects of learning. As a result, advocates are converging to commonly promote the idea that people generally need to learn to continuously adapt to and cope with their surroundings. Furthermore, the definition of human capital is evolving to encompass all knowledge and skills and a broader notion of well-being.

The changing concept of human capital coincides with the political rhetoric surrounding the concept of lifelong learning that has been used to promote the desirable effects of learning in recent years. The rhetoric aims to promote an active role to better manage and guide learning processes. This is done by emphasizing the benefits of learning and the consequences of not actively doing so. To effectively manage learning processes, however, a deeper look into the effects of various forms of learning is needed.

To better understand the effects of learning, the interaction between all forms of learning should be considered. There may exist substantial complementary or substitutability effects between two or more forms of learning, but analyzing only one form at a time does not identify these effects. Moreover, certain types of learning activities may have desirable effects that others do not. In these circumstances, it may be beneficial to identify these learning activities and promote them. To do this, however, indicators of various types of learning need to be developed and analyzed simultaneously.

Consequently, this article investigates the relationships between various forms of learning and how these forms affect indicators of economic and social well-being. Using the structural model and findings presented in Desjardins (in press), a further discussion about the implicit hypotheses is presented. To add a comparative perspective, however, the hypotheses are examined for an additional five countries. The models build on data

derived from the International Adult Literacy Survey (IALS) for Denmark, The Netherlands, Norway, the United Kingdom, and the United States, as well as Canada, which was the only country analyzed in Desjardins (in press). The Linear Structural Relations (LISREL) analytical approach is used to fit the models to the data sets.

The Structural Model

Figure 1 reproduces the generalized structural model presented in Desjardins (in press). Factors such as home background, age, nonnative language status, and gender are hypothesized to have an independent influence on the amount and quality of formal schooling one undertakes, and thus the amount of formal learning one realizes. The model then hypothesizes that the amount of formal learning realized affects the extent to which one will realize further informal and nonformal learning, both for job-related and personal-interest-related reasons. Cumulatively, all the learning realized, forms the stock of human capital. In turn, the stock of human capital affects economic and social well-being. The effect

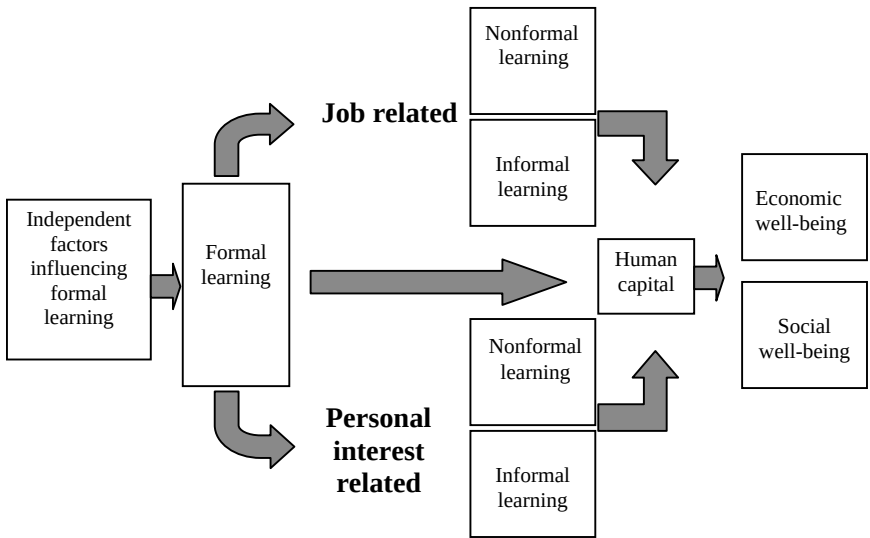


Figure 1. A generalized structural model of the effects of learning on economic and social well-being.

of cumulative learning on personal well-being could also be hypothesized, but due to a lack of appropriate data, this is not explored.

Data and Method

Data and Target Population

The generalized structural model presented in Figure 1 is empirically fitted to comparable data sets for six countries. The IALS was a 21-country cross-sectional literacy assessment of nationally representative samples of the adult population aged 16 to 65. The sample used in this article is restricted to the adult population aged 25 to 55, which is intended to represent the potentially productive population of a nation.¹ The estimated model, therefore, should be interpreted as examining how the stock of initial formal learning for the potentially productive population of a nation affects the flow of subsequent learning and in turn the flow of economic and social outcomes.

In general, available data often limit the operationalization of variables more than is desirable. To a certain extent, this is also the case here, but the IALS offers a unique opportunity to simultaneously assess the effect of various learning activities on a direct measure of skill, namely literacy skills, and in turn on indicators of well-being.

Indicators of Life-Wide Learning

Life-wide learning refers to all possible learning activities that occur at any point in the life span. This is a theoretical concept that conveniently classifies all learning as formal, nonformal, or informal (Colletta, 1996). The concept of nonformal education was originally coined by Coombs (1968) and began to gain currency in the 1970s (e.g., Coombs & Ahmed, 1974). In practice, however, classifying different learning activities according to this scheme can be difficult and subjective. Nevertheless, indicators of all three types of learning are constructed from the IALS data and used in the analysis presented in this article.

Learning and education are slightly different concepts, and thus it is noteworthy to clarify the use of these terms in defining the learning

¹Due to structural variations in the retirement systems of different countries, the age cohort 56 to 65 is excluded from the analysis. The age cohort 16 to 24 is also excluded because it is not possible to differentiate between full- and part-time students in the IALS data set.

indicators constructed. *Education* refers to an environment in which learning can potentially occur in an organized and taught manner; *learning* refers to any learning that actually occurs in either a taught, non-taught, organized, or unorganized environment. For example, formal *learning* occurs as a result of attending formal *education*. Notice that they are not necessarily the same. The concept of *education* is tangible, whereas the concept of *learning* is intangible. For this reason, the former is comparatively easy to measure and readily available in most household survey data sets.

Formal learning can occur as a result of participating in formal education. As a result, the variable is measured as a latent construct using two commonly available indicators of formal education, namely, level of educational attainment and years of schooling. Both are indicators of formal learning that has already occurred. Therefore, the formal learning variable represents an accumulation of learning, and it is a stock measure.

The IALS survey, however, does not have a cumulative measure of nonformal learning. It only contains a flow measure of participation in adult education and training. But it should be noted that prior longitudinal research has shown the strong predictive and cumulative tendencies inherent in adult education participation over time (Tuijnman, 1991). Therefore, the nonformal learning variables are constructed using this flow measure. In addition, a differentiation is made between nonformal learning undertaken for job-related and for personal-interest-related reasons. These theoretical variables are constructed using dichotomous indicators of participation in adult education and training for job-related and personal-interest-related reasons that occurred in the 12 months prior to the survey.

As defined in the Eurostat (2001) report, nonformal education refers to taught courses or lectures of nonformal educational or other institutions normally not constituting a continuous ladder of education and not necessarily leading to a formal qualification. This definition of nonformal education does not necessarily corroborate with adult education and training, because some adult education programs could be classified as formal. Formal education is defined in Eurostat (2001) as taught courses or lectures of recognized educational institutions normally constituting a continuous ladder of education that is to be completed with an examination and leading to a formal qualification (certificate, diploma, report card). Despite the lack of a perfect match between adult education and training and nonformal education, it is nevertheless convenient to take it as an indicator of nonformal learning. This is because participation in adult education and training is a flow measure, and because it is not

cumulative in the IALS, it is not possible to reconcile it with the stock of formal education. Consequently, adult education and training is interpreted as an indicator of nonformal learning flows that are likely to occur throughout adult life.

There are also no cumulative measures of informal learning activities available in the IALS, but there are flow measures of engagement in literacy activities both at work and at home. Eurostat (2001) defines informal learning as all remaining nontaught learning activities that can occur in all settings (e.g., at home/at work/in other environments). These activities can include both intentional and random learning. Given the evidence suggesting that engaging in various forms of literacy activities plays a critical role in sustaining and developing further literacy skills (e.g., Centre for Educational Research and Innovation [CERI], 1992, p. 14; Smith, 1996), these activities are taken as indicators of informal learning. The job-related informal learning variable is measured as a latent construct using indicators of the intensity of engaging in the following learning activities as part of their main job: read or use manuals, reference books, including catalogues; write or fill out letters or memos; and write or fill out reports or articles. The personal-interest-related informal learning variable is measured as a latent construct using indicators of the intensity of engaging in the following learning activities at home: reading books, writing letters or anything else that is more than one page in length, and use of a public library.

An indicator of the stock of human capital is also included in the analysis. The IALS data set uniquely contains direct measures of skills, namely prose, document, and quantitative literacy skills. These indicators are used to create a human capital latent construct. The human capital variable is not a part of the life-wide learning spectrum, but rather it is a cumulative outcome of engaging in all forms of learning.

Other Indicators

Labor force participation is also a flow variable, and it is measured by whether individuals were either employed or unemployed and looking for work at the time of the survey. The knowledge intensity of an individual's occupation is indicated by an index constructed using Standard Occupational Codes (SOC). One-digit SOCs were used for all countries except for Canada, where four-digit SOCs were available.

Annual earnings from wages and salaries and the frequency of participating in community activities indicate the economic and social well-being variables, respectively.

Method

The structural models were estimated with the LISREL method, using a maximum likelihood fit function. A correlation matrix with all the observed variables relevant to the measurement and structural model was computed using a preprocessor to the LISREL computer program. The latent constructs included in the measurement model were formulated using principal components analysis, which was used to examine the appropriateness of indicators. Overall, the method used in the analysis enabled the measurement errors of the theoretical variables to be taken into account when the structural relationships were estimated. A summary of the theories guiding the application of LISREL can be found in Jöreskog and Sörbom (1990).

Estimation Results

The same structural and measurement models were specified for all six countries. There were two separate analyses for each country, one with an economic outcome and the other with a social outcome. The common rule for an acceptable fit of a structural model is whether the goodness of fit (GFI) exceeds 90% (Hoyle & Panter, 1995; Tuijnman & Keeses, 1997) and the root mean square residual (RMR) is below 0.05 (Tuijnman & Keeses, 1997). According to these criteria, Table 1 shows that the model fit is acceptable for all countries.

A note of caution is due when comparing the relative magnitudes of the effects directly related to the economic outcome for the United Kingdom, because a categorical wage variable was used instead of a continuous wage variable. For this reason, the results of this model are not strictly comparable to the other countries, but are nonetheless reported due to the stability of the hypothesized structure in the other five countries.

Tables 3 and 4 report the results of the analysis and Figures 2 and 3 visually present the results. It is convenient to differentiate the strength of the paths in the structure when visually presenting the results. Table 2 classifies the standardized regression weights as a very strong effect, strong effect, moderate effect, weak effect, or not statistically significant effect.

Effects of Learning on Well-Being

The structural model presented in Figure 1 implicitly illustrates various hypotheses concerning the effects of learning on economic and social well-being. However, the main thrust of the model is that initial educa-

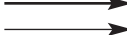
Table 1
Model Fit Statistics

	Economic Well-Being			Social Well-Being		
	R^2 ^a	RMR ^b	GFI ^c	R^2	RMR	GFI
United States	.354	.031	.935	.253	.031	.938
Canada	.583	.040	.908	.216	.040	.909
United Kingdom	.799 ^d	.028	.945	.166	.027	.946
Netherlands	.481	.048	.929	.079	.048	.926
Denmark	.493	.029	.935	.096	.029	.934
Norway	.441	.038	.914	.106	.039	.910

Note: International Adult Literacy Survey, 1994–1998.

^a R^2 denotes the proportion of variance explained in the structural equation. ^bRMR is a measure of the average of the fitted residuals. ^cGFI is the minimum of the fit function after the model has been divided into the fit function before the model has been fitted. ^dA continuous wage variable was not available for the United Kingdom, and a categorical variable was used instead. Because a categorical variable reduces the variability of a distribution, the R^2 for the United Kingdom is artificially inflated relative to that of the other countries.

Table 2
Classification of Standardized Regression Weights (RW)

Regression Weight	Scale	Symbol
$RW \geq 0.30$	Very strong effect	
$0.20 \leq RW < 0.30$	Strong effect	
$0.10 \leq RW < 0.20$	Moderate effect	
$RW < 0.10$	Weak effect	Not indicated
$RW = 0$	$p > .05$	*

tion has an effect on many variables, which in turn have an effect on economic and social well-being. In this analysis, labor force participation, the knowledge intensity of occupations, participation in job-related training, an intensity index of engaging in literacy activities at work, participation in personal-interest-related adult education, an intensity index of engaging in literacy activities at home, and skill are the variables hypothesized to mediate the effects of initial formal learning on well-being. These variables are referenced as intermediate variables, which have mediating effects. There are three hypotheses central to the structure of the model.

Table 3
Path Coefficients in a Model of Economic Well-Being (Maximum Likelihood Standardized Regression Weights)

United States									Canada									
η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2	η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2	
η_1								.39									.45	
η_2	.22							.11	.32								.14	
η_3	.62	-.07						.38	.42	.06							.22	
η_4	.48	*	.24					.39	.42	-.04	.31						.32	
η_5	.13	.15	.10	.32				.26	.14	.13	-.05	.27					.17	
η_6	.25	*	.11	.28	*			.45	.20	-.11	*	.34	.07				.42	
η_7	.09	-.12	*	*	*	.14		.07	*	-.06	*	*	*	.09			.01	
η_8	.31	.05	.09	.15	*	.09	.06	.59	.50	.08	*	.07	.05	.07	*		.54	
η_9	*	.37	.09	.28	.05	-.14	*	.17	.35	.06	.52	*	.32	.04	-.22	-.03	.12	.58
United Kingdom									The Netherlands									
η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2	η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2	
η_1								.37									.46	
η_2	.23							.09	.17								.23	
η_3	.71	-.06						.40	.71	-.05							.40	
η_4	.20	-.05	.53					.44	.30	*	.43						.43	
η_5	.10	.26	*	.38				.30	*	.18	-.07	.34					.17	
η_6	.44	*	-.05	.26	.08			.48	.42	-.10	*	.15	.06				.48	
η_7	*	*	-.06	*	-.03	.22		.06	*	*	*	*	*	.16			.04	
η_8	.24	.18	.15	.05	.04	.26	.04	.51	.38	.12	*	.13	*	*	.04		.43	
η_9	.20	.54	.08	.40	.03	-.31	-.02	.14	.80	.16	.27	.06	.31	*	-.19	*	.07	.48
Denmark									Norway									
η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2	η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2	
η_1								.21									.29	
η_2	.22							.07	.13								.04	
η_3	.63	-.06						.39	.56	*							.36	
η_4	.28	*	.36					.32	.08	.07	.58						.45	
η_5	.08	*	.11	.24				.15	*	.17	*	.23					.13	
η_6	.37	-.18	*	.15	.07			.47	.29	-.13	*	.30	*				.36	
η_7	*	*	*	*	-.12	.20		.04	.08	-.08	-.09	.12	-.07	*			.02	
η_8	.22	.11	.13	.12	.05	.12	.04	.41	.10	.14	.11	.13	.05	.15	*		.36	
η_9	.05	.62	-.05	.12	.06	*	*	.09	.49	.05	.56	*	.10	*	-.16	*	.17	.44

Note: International Adult Literacy Survey, 1994–1998. η_1 indicates initial formal learning (ED); η_2 indicates labor force participation (LFP); η_3 indicates knowledge intensity of occupation (KNO); η_4 indicates literacy practice at work (WLIT); η_5 indicates job-related adult education and training (JT); η_6 indicates literacy practice at home (HLIT); η_7 indicates personal-related adult education (PT); η_8 indicates skill (SKI); η_9 indicates earned wages/salaries (EA).

* $p > .05$, not statistically significant.

Table 4

Path Coefficients in a Model of Social Well-Being (Maximum Likelihood Standardized Regression Weights)

United States										Canada									
η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2		η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2	
η_1								.37											.45
η_2	.23							.11		.32									.14
η_3	.59	-.06						.36		.42	.06								.22
η_4	.49	*	.25					.40		.39	*	.31							.31
η_5	.12	.15	.10	.32				.26		.14	.13	-.05	.27						.17
η_6	.19	*	.13	.29	*			.44		.22	-.12	*	.34	.07					.41
η_7	.08	-.12	*	*	*	.16		.07		*	-.06	*	*	*	.09				.01
η_8	.26	.05	.11	.15	*	.10	.06	.58		.50	.08	*	.07	.05	.07	*			.54
η_9	*	-.07	*	*	.05	.46	*	.06	.25	*	.07	*	-.12	.14	.34	.12	.18		.22
United Kingdom										The Netherlands									
η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2		η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2	
η_1								.37											.46
η_2	.23							.09		.17									.23
η_3	.71	-.06						.40		.71	-.05								.40
η_4	.20	-.05	.53					.44		.30	*	.43							.43
η_5	.10	.26	*	.38				.30		*	.18	-.07	.34						.17
η_6	.44	*	-.05	.25	.08			.47		.42	-.10	*	.15	.06					.48
η_7	*	*	-.06	*	-.03	.22		.06		*	*	*	*	*	.16				.04
η_8	.25	.18	.15	.05	.04	.25	.04	.51		.38	.12	*	.14	*	*	.04			.43
η_9	.10	*	*	*	*	.29	.06	.08	.17	-.09	-.14	*	.09	*	.19	.06	.12		.08
Denmark										Norway									
η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2		η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2	
η_1								.21											.29
η_2	.22							.07		.13									.04
η_3	.63	-.05						.39		.56	*								.36
η_4	.28	*	.36					.32		.08	.07	.58							.45
η_5	.08	*	.11	.24				.15		*	.17	*	.23						.13
η_6	.38	-.18	*	.15	.07			.47		.29	-.13	*	.31	*					.36
η_7	*	*	*	*	-.12	.20		.04		.08	-.08	-.09	.12	-.07	*				.02
η_8	.22	.11	.13	.12	.05	.12	.04	.41		.10	.14	.11	.13	.05	.15	*			.36
η_9	*	*	-.07	.10	*	.17	.10	.09	.10	*	.08	*	*	*	.26	.05	.09		.11

Note: International Adult Literacy Survey, 1994–1998. η_1 indicates initial formal learning (ED); η_2 indicates labor force participation (LFP); η_3 indicates knowledge intensity of occupation (KNO); η_4 indicates literacy practice at work (WLIT); η_5 indicates job-related adult education and training (JT); η_6 indicates literacy practice at home (HLIT); η_7 indicates personal-related adult education (PT); η_8 indicates skill (SKI); η_9 indicates intensity of engaging in volunteer or community organizations (COMM).

* $p > .05$, not statistically significant.

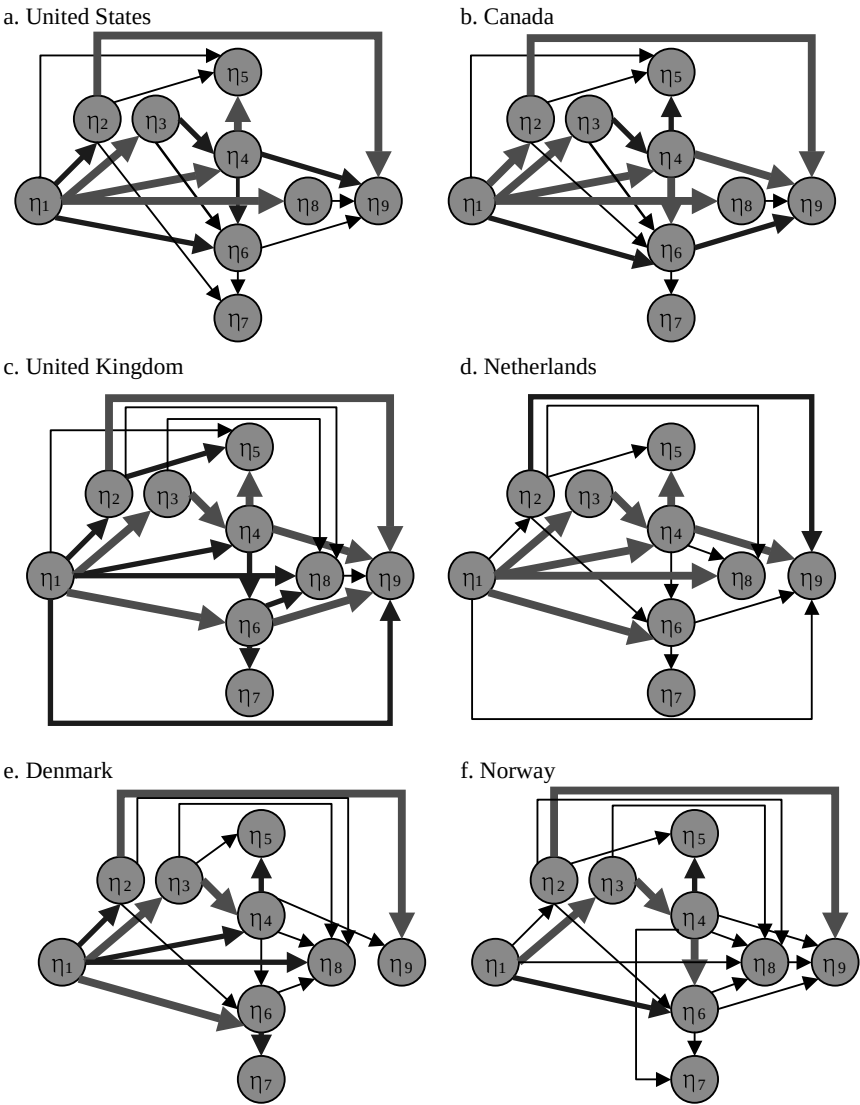
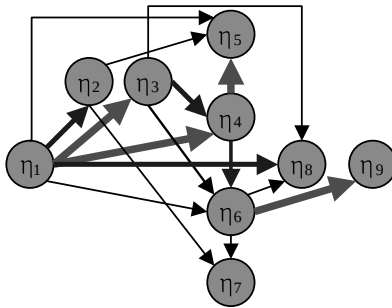
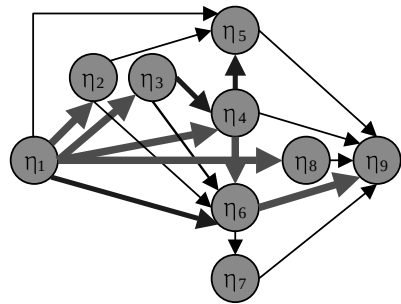


Figure 2. Strength of path coefficients in a model of economic well-being. *Note:* International Adult Literacy Survey, 1994–1998. η_1 indicates formal learning (ED); η_2 indicates labor force participation (LFP); η_3 indicates knowledge intensity of occupation (KNO); η_4 indicates literacy practice at work (WLIT); η_5 indicates job-related adult education and training (JT); η_6 indicates literacy practice at home (HLIT); η_7 indicates personal-related adult education (PT); η_8 indicates skill (SKI); η_9 indicates earned wages/salaries (EA).

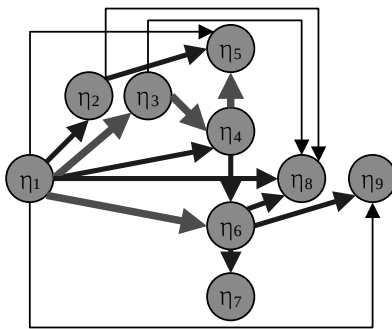
a. United States



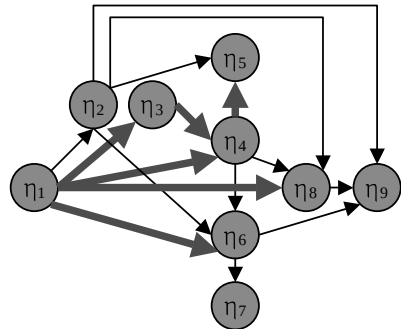
b. Canada



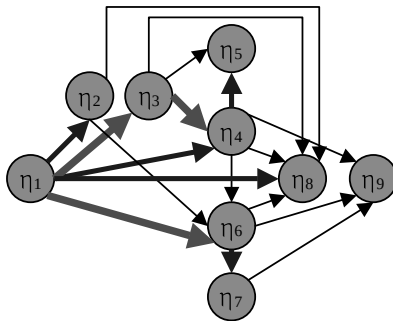
c. United Kingdom



d. Netherlands



e. Denmark



f. Norway

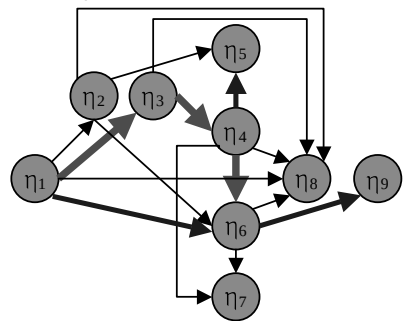


Figure 3. Strength of path coefficients in a model of social well-being. *Note:* International Adult Literacy Survey, 1994–1998. η_1 indicates formal learning (ED); η_2 indicates labor force participation (LFP); η_3 indicates knowledge intensity of occupation (KNO); η_4 indicates literacy practice at work (WLIT); η_5 indicates job-related adult education and training (JT); η_6 indicates literacy practice at home (HLIT); η_7 indicates personal-related adult education (PT); η_8 indicates skill (SKI); η_9 indicates intensity of engaging in volunteer or community organizations (COMM).

1. Initial formal learning has a positive direct effect on subsequent learning.
2. Subsequent learning has a positive direct effect on economic and social well-being.
3. The effect of initial formal learning on well-being is significantly mediated by subsequent learning activities.

The following discussion assesses these hypotheses in relation to the estimation results of the model presented.

Direct Effects of Initial Formal Learning on Subsequent Learning

The first hypothesis concerns the causal effect of initial formal learning on subsequent learning throughout adult life. Initial schooling is strongly believed to play a critical role in preparing adults' willingness to learn throughout the life span. Some studies have found evidence to support this hypothesis (e.g., Johnstone & Rivera, 1965). More recent findings presented in the OECD and Human Resources Development Canada (HRDC) (1997) report suggest that in the 11 countries studied, people with higher levels of formal education are more likely to participate in adult education and training and are also more likely to engage in literacy activities at work. The analysis conducted in this study, however, separates adult education and training taken for job-related and personal-interest-related reasons. The correlation between the adult education and training taken for different reasons is not statistically different from zero in any of the six countries, and as a consequence, they may be affected by initial education and affect well-being in different ways. The analysis also simultaneously includes informal learning undertaken at work and at home.

Table 5 presents the direct effects of initial education on subsequent learning. The relative strengths of the effects appear to vary significantly, and depending on the country, the results suggest that initial education does not necessarily exert a positive causal effect on all subsequent learning. Except for Norway and the United States, initial education is not exerting a statistically significant effect on personal-interest-related adult education. But even in Norway and the United States, this effect is weak. In Canada and the United States, the strongest effect is on work literacy practice, whereas in Denmark, Norway, The Netherlands, and the United Kingdom, it is on home literacy practice.

The Effects of Learning on Economic and Social Well-Being

Table 5

The Direct Effect of Initial Formal Education on Subsequent Learning (Maximum Likelihood Standardized Regression Weights)

	United States	Canada	United Kingdom	The Netherlands	Denmark	Norway
a. Economic Well-Being						
Work literacy practice	.48	.42	.20	.30	.28	.08
Job-related training	.13	.14	.10	*	.08	*
Home literacy practice	.25	.20	.44	.42	.37	.29
Personal-interest adult education	.09	*	*	*	*	.08
b. Social Well-Being						
Work literacy practice	.49	.39	.20	.30	.28	.08
Job-related training	.12	.14	.10	*	.08	*
Home literacy practice	.19	.21	.44	.42	.38	.29
Personal-interest adult education	.08	*	*	*	*	.08

Note: International Adult Literacy Survey (1994–1998).

* $p > .05$, not statistically significant.

Direct Effects of Subsequent Learning on Well-Being

The model further hypothesizes that subsequent learning activities have a direct effect on both economic and social well-being. Theory and evidence in the field of economics of training suggest that job-related learning has a positive effect on economic well-being by increasing productivity (e.g., Becker, 1962, 1993; Cohn & Addison, 1998; Mincer, 1962, 1974). Similarly, socialization theory suggests that learning has a positive effect on social well-being by encouraging individuals to be a part of society (Sturman, 1997). Hodgkinson and Weitzman (1988) provided evidence that suggests schooling increases charitable giving in terms of both volunteer time and financial donations. In this analysis, participating in the community is taken as an indicator of individuals actively contributing to society and in this way contributing to social well-being.

It is important for the interpretation of the results in Table 6a to acknowledge that the subsequent learning activities in the analysis are not cumulative measures, but flow measures. This is due to a lack of available cumulative data. Moreover, job-related training includes both paid on-the-job training and unpaid off-the-job training; therefore, its effect on the same period earnings flow is confounded. That is, unpaid off-the-job

training is likely to have a negative effect on earnings from the same period, whereas paid on-the-job training is likely to have a positive effect on earnings from the same period. Nevertheless, job-related training, as a flow measure, has a weak causal effect on the same period earnings in Canada, Denmark, the United Kingdom, and the United States.

Informal learning at work, as defined by the intensity of engaging in literacy activities at work, exhibits the strongest causal effect on economic well-being in all countries except Norway. The strongest effects for Norway are skills and literacy practice at home, but the latter effect is negative. Similarly, the effect of literacy practice at home has a negative effect on economic well-being in all other countries except Denmark, where it is not statistically different from zero. Personal-interest-related adult education has a weak negative effect on economic well-being in both Canada and the United Kingdom, but it is not statistically significant in the other countries.

In summary, flows of informal learning activities undertaken for *personal-interest-related* reasons appear to have a moderate to very strong *negative* effect on economic well-being, except in Denmark, where there is no statistically significant effect. Flows of informal learning undertaken for

Table 6
The Direct Effect of Subsequent Learning on Well-Being (Maximum Likelihood Standardized Regression Weights)

	United States	Canada	United Kingdom	The Netherlands	Denmark	Norway
a. Economic Well-Being						
Work literacy practice	.28	.32	.40	.31	.12	.10
Job-related training	.05	.04	.03	*	.06	*
Home literacy practice	-.14	-.22	-.31	-.19	*	-.16
Personal-related adult education	*	-.03	-.02	*	*	*
Literacy skill	.17	.12	.14	.07	.09	.17
b. Social Well-Being						
Work literacy practice	*	-.12	*	.09	.10	*
Job-related training	.05	.14	*	*	*	*
Home literacy practice	.46	.34	.29	.19	.17	.26
Personal-related adult education	*	.12	.06	.06	.10	.05
Literacy skill	.06	.18	.08	.12	.09	.09

Note: International Adult Literacy Survey (1994–1998).

* $p > .05$, not statistically significant.

job-related reasons have a moderate to very strong *positive* effect on economic well-being in all six countries.

Table 6b, on the other hand, presents the direct effect of subsequent learning on social well-being. In contrast to economic well-being, it appears that literacy practice at home has a significant positive effect on social well-being in all countries. With the exception of the United States, personal-interest-related adult education has a weak to moderate positive effect on social well-being.

The results here and in the previous section suggest that subsequent learning may significantly mediate the effect of initial formal learning on well-being. Although initial education has a positive effect on well-being and subsequent learning, not all flows of learning appear to have positive effects on economic and social well-being. As it would appear from the results, it is conceivable that education has a positive effect on some intermediate variables that in turn have a negative effect on economic well-being. Although they have a negative effect on economic well-being, they do have a positive effect on social well-being. This finding confirms the importance of differentiating between economic and social outcomes. These results are discussed further when the mediating effects of subsequent learning on well-being are examined in the next section.

Direct Effects of Initial Formal Learning and Indirect Effects of Subsequent Learning on Economic Well-Being

The third hypothesis states that subsequent learning significantly mediates the effect of initial education on economic and social well-being. This section separately evaluates the mediating effect of subsequent learning on economic well-being.

There is an overwhelming amount of evidence supporting the causal effect of initial education on economic well-being (e.g., Cohn & Addison, 1998; Psacharopoulos, 1985, 1994), but the magnitude of the true causal effect and the mechanism causing it are still debated (Card, 1999). Some argue that the effect is overstated because those who earn more may have an innate ability to do so. Although this may be the case, there is little evidence to show that the effect is anything but at least positive. The argument, rather, is about whether the magnitude of the effect is high enough to justify increased levels of investment in initial education. This article, however, is interested in the mechanisms causing the effect.

Can the web of causal effects best be explained by the human capital theory (Becker, 1962, 1993; Mincer, 1962, 1974; Schultz, 1961) or the screening

theory (Arrow, 1973; Spence, 1973)? The causal mechanisms proposed by the two theories are quite different, and as a consequence, so are the implications for policy and welfare. The human capital theory, under neo-classical assumptions, suggests that acquiring more knowledge and skills increases productivity, as reflected through increased earnings. The screening theory suggests that credentials act as market signals that lead to better and more efficient allocations in the labor market whereby more able and hence more productive workers are correctly matched with relatively higher paying jobs.

It is hypothesized for the purposes of the analyses undertaken in this article that the mechanisms are likely to be best explained by a combination of the two theories. The structural model presented here does not subsume the screening theory, but the main thrust of the model relies on human capital theory and, more precisely, on the definition of human capital (OECD, 2001, p. 18) already stated.

Although the model assumes that well-being is a function of acquiring knowledge and skills, it does not rule out a credential effect. Initial education can still serve as a screener by enabling access into the labor force and providing individuals with a better chance to engage in subsequent learning, at least job-related subsequent learning. The main hypothesis remains that it is by engaging in subsequent learning that economic well-being will be affected. In other words, the continued inflow of knowledge and skills will drive the effect of initial education on well-being. In this context, the primary role of initial education is not to transfer knowledge and skills but to increase adults' readiness to learn throughout life.

The results presented in Table 7 suggest that in all six countries, the effect of initial education on economic well-being is significantly mediated by the intermediate variables included in the analysis. For example, the

Table 7

The Direct and Indirect Effects of Initial Education on Economic Well-Being (Maximum Likelihood Standardized Regression Weights)

	<i>United States</i>	<i>Canada</i>	<i>United Kingdom</i>	<i>The Netherlands</i>	<i>Denmark</i>	<i>Norway</i>
Direct effect	*	.06	.20	.16	.05	.05
Indirect effect	.34	.34	.31	.21	.23	.10
Total effect	.34	.40	.51	.37	.27	.15

Note: International Adult Literacy Survey (1994–1998).

* $p > .05$, not statistically significant.

effect of initial education in the United States is entirely mediated. In proportional terms, the least amount of mediation occurs in The Netherlands, where the direct effect of education remains relatively strong. In absolute terms, the results suggest that initial education has a small effect in Denmark and Norway. This is consistent with the generally egalitarian nature of the labor compensation systems of these two countries.

Table 8 suggests that over half of the indirect effect occurs through labor force participation and the knowledge intensity of occupations. This suggests that initial education plays a significant role in influencing economic well-being by enabling access to the labor market and knowledge-intensive occupations.

Except for Norway, Table 8 suggests that work literacy practice substantially mediates the effect of initial education on economic well-being. People with higher levels of initial education are not only more likely to secure access to knowledge-intensive occupations but are also more likely to engage in literacy practice at work. These effects are strongest in Canada and the United States.

At this point, it is important to point out a technical limitation in the empirical analyses presented. For the models to adhere to recursive modeling principles, it is necessary to assume a one-way causation between learning for job-related reasons and learning for personal-interest related reasons. However, it is difficult to theoretically justify a one-way causation in either direction, even though there appears to be a strong empirical relation between the two in all six countries. Using a two-staged least squares method in the LISREL computer program, an effort was made to estimate the reciprocal relation between the two. These findings indicate that when a reciprocal relation between work literacy practice and home literacy practice is modeled, the causation is strong and approximately equal in both directions for all six countries. A two-stage least squares method is less than optimal, however, because it may provide slightly biased parameter estimates, and as such, it was only used for modeling purposes. Therefore, a one-way causal assumption was necessary for obtaining maximum likelihood estimates, which are deemed better. In Tables 8 and 10, two separate models (indicated by a and b) were reported to account for the impact of reversing the causation assumed between learning for job-related and personal-interest-related reasons. The results indicate that this assumption does not alter the main findings of the analyses. There are slight variations, however.

Regardless of the causal direction assumed between learning for work-related or personal-interest-related reasons, the overall mediating effect of subsequent learning is not straightforward. Home literacy practice negatively mediates the effect of initial education on economic well-being in

Table 8

Percent of the Total Effect of Initial Formal Learning Mediated by Labor Force Variables, Subsequent Learning Activities, and Skills: Model of Economic Well-Being

	<u>United States</u>		<u>Canada</u>		<u>United Kingdom</u>		<u>The Netherlands</u>		<u>Denmark</u>		<u>Norway</u>	
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>
(percent)												
Labor force variables												
Labor force participation	25	25	52	53	39	37	23	22	62	68	77	73
Knowledge intensity of occupation	28	28	10	11	67	64	61	62	7	*	37	38
	53	53	62	64	106	102	84	84	69	68	114	112
Inflows of job-related knowledge and skills												
Work literacy practice	39	34	32	26	22	8	41	28	18	15	7	*
Job-related training	2	2	1	1	*	1	*	*	2	*	*	*
	41	36	33	28	23	9	41	28	20	15	7	*
Inflows of personal-related knowledge and skills												
Home literacy practice	-9	-4	-13	-10	-40	-20	-38	-24	2	7	-39	-29
Personal-related adult education	*	*	*	*	*	*	*	*	*	*	*	*
	-9	-4	-13	-10	-40	-20	-38	-24	2	7	-39	-29
Net effect of subsequent learning												
	32	32	21	18	-17	-11	3	4	22	23	-32	-29
Stock of knowledge and skills												
Literacy skill	15	15	18	18	11	10	13	12	9	9	18	17

Note: International Adult Literacy Survey (1994–1998). a. Model assumes that learning for job-related reasons affects learning for personal-interest-related reasons. This is the model presented in all other analyses. b. Model assumes that learning for personal-interest-related reasons affects learning for job-related reasons. This model is shown here to demonstrate the impact of assuming the one-way causation between learning for personal-interest-related reasons and for job-related reasons on the results of the analyses.

**p* > .05, not statistically significant.

all of the countries except Denmark. Despite controlling for labor force participation and occupation, these results suggest that initial education has a negative effect on economic well-being by increasing adults' readiness to learn for personal-interest-related reasons. The reason for this might be that personal-interest-related learning is diverting attention

from job-related learning at the expense of economic well-being. The implications of this phenomenon on social well-being are discussed in a subsequent section.

Flows of job-related training are shown to have a negligible mediating effect in Canada and the United States but there is no effect in The Netherlands or Norway. It is important to note when pondering this result, however, that this is judged against the economic well-being of the same period. It would be more appropriate to judge the effect of this type of learning against lifetime earnings, as suggested by Becker's (1962) theory. However, these data are not available for this analysis.

Personal-interest adult education does not appear to have a statistically significant role in mediating the effect of initial education on economic well-being. Again, it would be more interesting to judge this effect against lifetime earnings.

Finally, the model hypothesizes that all forms of learning cumulatively contribute to the stock of knowledge and skills. Theoretically, the stock of human capital should account for all past flows of learning that have occurred. This follows in the analysis presented here, at least to the extent that past learning has contributed to the formation of literacy skills. As Table 8 suggests, literacy skills positively mediate the effect of initial education on economic well-being in all six countries. The mediating role of literacy skills is the strongest in Canada, Norway, and the United States.

Effect of Learning on Economic Vis-à-Vis Social Well-Being

The previous section provided mixed evidence for the hypothesis that the effect of initial education on economic well-being occurs as a result of adults' readiness to learn. Except for Denmark, the results showed that adults' readiness to engage in personal-interest-related learning reduced the total effect of initial education on economic well-being. This finding contradicts the hypothesis. At the same time, readiness to engage in job-related learning has a positive effect, which supports the hypothesis. These effects, however, were on economic well-being only and did not consider the broader notion of well-being, which also includes social well-being. How does adults' readiness to learn affect social well-being?

If one considers that time is a scarce resource, and that people must make choices of how to allocate their time between different learning activities to achieve what they desire (Becker, 1965), then the results of the

previous section are not too surprising. Placing a relatively higher value on social or personal well-being may divert time away from learning that would otherwise improve economic well-being. Depending on the objectives of different societies, this type of learning should not be interpreted as negative. In fact, these interrelationships and effects should be investigated further and be better understood to pursue policies consistent with societal objectives. Consequently, additional hypotheses are formulated and examined:

- 4. The more one engages in learning for job-related reasons vis-à-vis personal-interest-related reasons, the less favorable the social outcome.
- 5. The more one engages in learning for personal-interest-related reasons vis-à-vis job-related reasons, the more favorable the social outcome.

The approach used to assess these hypotheses assumes that people have to choose how much of their time they will devote to various types of learning initiatives, and in turn, this will affect their well-being. Moreover, social well-being is separately examined to assess how different learning activities affect different kinds of well-being. The estimated model assumes the same structure as in the model of economic well-being.

Similar to the results for the model of economic well-being, Table 9 shows that in all six countries, the effect of initial education on social well-being is significantly mediated by the intermediate variables. The effects are entirely mediated in Canada, Denmark, Norway, and the United States. However, direct effects of initial education on social well-being remain for The Netherlands and the United Kingdom. The result for The Netherlands suggests that initial education has a negative direct effect on

Table 9
The Direct and Indirect Effects of Initial Education on Social Well-Being (Maximum Likelihood Standardized Regression Weights)

	<i>United States</i>	<i>Canada</i>	<i>United Kingdom</i>	<i>The Netherlands</i>	<i>Denmark</i>	<i>Norway</i>
Direct effect	*	*	.10	−.09	*	*
Indirect effect	.24	.23	.22	.19	.12	.15
Total effect	.24	.23	.32	.11	.12	.15

Note: International Adult Literacy Survey (1994–1998).
**p* > .05, not statistically significant.

social well-being, which is contradictory to socialization theory and raises questions about the reliability of the social well-being indicator used for that country.

Consistent with the idea that there is a trade-off in time use implicit in Hypotheses 4 and 5, Tables 8 and 10 suggest that although participating in the labor force has a positive mediating effect on economic well-being, it has a negative mediating effect on social well-being in Denmark, The Netherlands, and the United States. Interestingly, the knowledge intensity of one's occupation maintains a positive mediating effect except in Denmark.

In contrast to the results for the model of economic well-being, Table 10 shows that home literacy practice positively mediates the effect of initial education on social well-being in all six countries. Moreover, it is the strongest mediating factor included in the model. This suggests that home literacy practice (or informal personal-interest-related learning) is an important determinant of social well-being. These results support the hypothesis that engaging in more personal-interest-related learning vis-à-vis job-related learning is likely to lead to more favorable social outcomes. The reverse does not follow from the results.

According to Table 10, informal job-related learning does not negatively mediate the effect of initial education on social outcomes, with the possible exception of Canada. Reversing the causal assumption between learning for job-related and personal-interest-related reasons (i.e., models a and b) provides mixed results here, but the mediation is relatively low in Norway and the United Kingdom and relatively high in Denmark and The Netherlands. So in aggregate terms, the results do not support the hypothesis that engaging in more job-related learning vis-à-vis personal-interest-related learning is likely to cause a less favorable social outcome.

Adult education taken for personal-interest-related reasons does not significantly affect current period flows of social well-being. Except in Canada and the United States, adult training taken for job-related reasons does not either. Similar to economic well-being, literacy skills appear to positively mediate the effect of initial education on social well-being. This effect is strongest for Canada, Denmark, and The Netherlands.

Summary and Conclusion

The comparative analysis reconfirms the main hypothesis in Desjardins (in press) for an additional five countries, which asserted that the effect of initial schooling on well-being is more complex than direct, and it

Table 10
Percent of the Total Effect of Initial Education Mediated by Labor Force Variables, Subsequent Learning Activities, and Skills: Model of Social Well-Being

	<i>United States</i>		<i>Canada</i>		<i>United Kingdom</i>		<i>The Netherlands</i>		<i>Denmark</i>		<i>Norway</i>	
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>
(percent)												
Labor force variables												
Labor force participation	-7	-6	8	7	1	1	-13	-17	-5	-3	6	6
Knowledge intensity of occupation	28	22	2	6	14	14	22	19	-6	*	25	22
	22	16	10	13	15	15	9	2	-10	-3	30	28
Inflows of job-related knowledge and skills												
Work literacy practice	33	3	10	-11	9	*	22	12	31	22	6	*
Job-related training	3	2	10	7	1	*	*	*	*	*	*	*
	36	6	21	-4	10	*	22	12	32	22	6	*
Inflows of personal-related knowledge and skills												
Home literacy practice	36	71	32	54	66	75	44	61	62	64	55	62
Personal-related adult education	*	*	*	*	*	*	*	*	*	*	3	3
	36	71	32	54	66	75	44	61	62	64	57	65
Net effect of subsequent learning												
	72	77	53	50	76	76	66	73	94	86	63	65
Stock of knowledge and skills												
Literacy skill	7	7	38	37	9	9	24	26	16	17	7	7

Note: International Adult Literacy Survey (1994–1998). a. Model assumes that learning for job-related reasons affects learning for personal-interest-related reasons. This is the model presented in all other analyses. b. Model assumes that learning for personal-interest-related reasons affects learning for job-related reasons. This model is shown here to demonstrate the impact of assuming the one-way causation between learning for personal-interest-related reasons and for job-related reasons on the results of the analyses.

**p* > .05, not statistically significant.

is significantly mediated by subsequent learning. The findings in Desjardins (in press) also suggested that there might be a trade-off between learning for different reasons. Consequently, additional hypotheses were formulated and comparatively examined in this article.

In general, the findings suggest that people who devote more time to learning for job-related reasons than learning for personal-interest-related reasons experience higher levels of economic well-being. Devoting too

much time to learning for personal-interest-related reasons has a negative effect on economic well-being except in Denmark. But the more time people devote to learning for personal-interest-related reasons tends to contribute to higher levels of social well-being. These results suggest a trade-off in learning for different reasons or in different contexts.

The results also show that learning for different reasons appears to be related, but there are no theories presented in this article to support how they could be related. This observation suggests that although excessive job-related learning may have a direct negative impact on social well-being in some countries—as it does in Canada—it may also lead to more learning for personal-interest-related reasons, which in turn has a positive influence on social well-being. Thus, learning for job-related reasons might be enhancing social well-being rather than harming it. However, personal-interest-related learning appears to be significantly influential in mediating the effect of initial education on social well-being. As a consequence, policies should not ignore this, and ways to promote this type of learning should be encouraged.

Furthermore, the interaction between learning for personal-interest and job-related reasons might be an indication that there is an interaction between social and economic well-being. The effect of social well-being on economic well-being or vice versa is not modeled here, but this would be an interesting issue to explore. Neither is the effect of personal well-being on economic well-being examined, because of a lack of available data. It is likely, however, that learning for personal-interest-related reasons would exert its greatest effect on personal well-being. Moreover, it would be interesting to examine whether learning for job-related reasons reduces or increases personal well-being. Such models would be in the spirit of the new approach to human capital.

References

- Arrow, K. (1973). Higher education as a filter. *Journal of Public Economics*, 2, 193–216.
- Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of Political Economy*, 70(5), 9–49.
- Becker, G. S. (1965). A theory of the allocation of time. *Economic Journal*, 75(299), 493–517.
- Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis with special reference to education* (3rd ed.). Chicago: University of Chicago Press.
- Card, D. (1999). The causal effect of education on earnings. In O. Ashenfelter & D. Card (Eds.), *Handbook of labor economics* (Vol. 3, pp. 1801–1863). Amsterdam: Elsevier.
- Centre for Educational Research and Innovation. (1992). *Adult illiteracy and economic performance*. Paris: Organization for Economic Cooperation and Development.
- Cohn, E., & Addison, J. (1998). The economics returns to lifelong learning in OECD countries. *Education Economics*, 6, 253–308.

- Colletta, N. J. (1996). Formal, nonformal, and informal education. In A. C. Tuijnman (Ed.), *International encyclopaedia of adult education and training* (2nd ed., pp. 22–27). Oxford, England: Pergamon.
- Coombs, P. H. (1968). *The world educational crisis: A systems analysis*. Oxford, England: Oxford University Press.
- Coombs, P. H., & Ahmed, M. (1974). *Attacking rural poverty: How non-formal education can help*. Baltimore: John Hopkins University Press.
- Delors, J. (1996). *Learning: The treasure within*. Paris: UNESCO.
- Desjardins, R. (in press). Determinants of economic and social outcomes from a life-wide learning perspective in Canada. *Education Economics*.
- Eurostat. (2001). *Report of the Eurostat Task Force on measuring lifelong learning*. Brussels, Belgium: Author.
- Hodgkinson, V., & Weitzman, M. (1988). *Giving and volunteering in the United States: Findings from a national survey, 1988 edition*. Washington, DC: Independent Sector.
- Hoyle, R. H., & Panter, A. T. (1995). Writing about structural equations models. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 158–176). London: Sage.
- Johnstone, J. W. C., & Rivera, R. J. (1965). *Volunteers for learning: A study of the educational pursuits of American adults*. Chicago: Aldine.
- Jöreskog, K. G., & Sörbom, D. (1990). Linear structural relations analysis. In T. Husen & T. N. Postlethwaite (Eds.), *The international encyclopedia of education, supplementary volume II* (pp. 368–376). Oxford, England: Pergamon.
- Mincer, J. (1962). On the job training: Costs, returns and some implications. *Journal of Political Economy*, 70(2), 50–79.
- Mincer, J. (1974). *Schooling, experience and earnings*. New York: Columbia University Press.
- Organization for Economic Cooperation and Development. (2001). *The well-being of nations: The role of human and social capital*. Paris: Author.
- Organization for Economic Cooperation and Development & Human Resources Development Canada. (1997). *Literacy for the knowledge society: Second report of the International Adult Literacy Survey*. Paris and Ottawa: Authors.
- Psacharopoulos, G. P. (1985). Returns to education: A further international update and implications. *Journal of Human Resources*, 20, 583–604.
- Psacharopoulos, G. P. (1994). Returns to investment in education: A global update. *World Development*, 22, 1325–1343.
- Schultz, T. W. (1961). Investment in human capital. *American Economic Review*, 51(1), 1–17.
- Smith, M. C. (1996). Differences in adults' reading practices and literacy proficiencies. *Reading Research Quarterly*, 31, 196–219.
- Spence, M. (1973). Job market signaling. *Quarterly Journal of Economics*, 87, 355–374.
- Sturman, A. (1997). Socialization. In L. J. Saha (Ed.), *International encyclopedia of the sociology of education* (pp. 528–533). Oxford, England: Pergamon.
- Tuijnman, A. C. (1991). Lifelong education: A test of the accumulation hypothesis. *International Journal of Lifelong Education*, 10, 275–285.
- Tuijnman, A. C., & Keeves, J. P. (1997). Path analysis and linear structural relations analysis. In J. P. Keeves (Ed.), *Educational research methodology and measurement: An international handbook* (2nd ed., pp. 621–633). Oxford, England: Pergamon.

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Determinants of Economic and Social Outcomes from a Life-Wide Learning Perspective in Canada

RICHARD DESJARDINS

ABSTRACT *The notion that the knowledge and skills embodied in individuals contribute to the creation of economic and social benefits is not a new concept. But in practice little is known about the extent and relative influence of how different learning activities contribute to the formation of one's knowledge and skills, and in turn their relative influence in generating different kinds of benefits. Studies either focus on one form of learning or the other, and for the most part they tend to focus on indicators of formal education. To improve the understanding of how education and learning lead to the creation of economic and social benefits, a comprehensive approach drawing on all the potential sources of knowledge and skills should be applied. Accordingly, the primary objective of the present article is to measure the relative influence of engaging in various learning activities—spanning the 'life-wide' spectrum of learning—on economic and social benefits. The study presents a conceptual framework and uses data from the Canadian Adult Literacy Survey to estimate corresponding structural models. The findings provide support for the hypotheses formulated; namely, that the relationship between formal education and economic and social outcomes is complex, with confounding effects. The results indicate that different types of learning activities taken for different reasons lead to different kinds of benefits. The latter finding suggests a potential trade-off between attaining economic and social benefits through different types of learning activities that are taken for either job-related or personal interest-related reasons. The article concludes that further in-depth analyses are required to improve the understanding of the complex relationship between various learning activities and the benefits they generate.*

Introduction

Numerous studies have attempted to estimate the economic and social benefits of acquiring knowledge and skills (Solmon & Fagnano, 1994). These studies have suggested that the knowledge and skills embodied in individuals potentially contribute to the creation of benefits in both the economic and social spheres of human life. But, conventionally, investigations of the economic benefits have not usually taken the social benefits into consideration. Most investigations have been

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conducted within a narrow conception of the human capital paradigm, which focuses on economic outcomes. This narrow approach follows from the definition of human capital presented by Woodhall:

Human capital refers to the fact that human beings invest in themselves, by means of education, training, and other activities to potentially increase the present value of their future stream of net income (Woodhall, 1995, p. 24)

This definition classifies knowledge and skills as human capital only if they will improve economic well-being, and ignores the effect of knowledge and skills on social and personal well-being. In the latter cases, the resources expended to acquire knowledge and skills are usually classified as consumption, not investments.

In recent years, however, there has been an important strand of literature that has emerged, which seeks to further investigate the externalities associated with learning. In particular, McMahon (1999, 2001) isolates the indirect effects of education on economic outcomes via other outcomes such as the non-monetary social and private benefits of education. Explicitly modelling and estimating the externalities of education are not incompatible with the definition presented in Woodhall (1995), however. But these approaches have moved beyond the conventional approach by explicitly taking into consideration the social and personal benefits of learning when attempting to explain the economic benefits of education. This has largely been spurred by the groundbreaking work of Lucas (1988) and Romer (1990), which began to explicitly model the externalities associated with the production of human capital.

In concurrence to this development, there has also been a changing attitude toward the conceptualization of human capital. This is apparent in a recent OECD report on the *The Well-Being of Nations*, which asserts a definition of 'Human Capital' that now acknowledges social and personal well-being as ends in themselves:

The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being. (OECD, 2001, p. 18)

This definition implies that the acquisitions of knowledge and skills, which can potentially lead to social and personal well-being, even without affecting economic well-being, are also justified as investments. This approach is consistent with Becker's (1965) 'Full Income' concept. Becker (1965) models the use of time and all other resources as inputs into a household production function that produces final satisfactions. He argues that if all these satisfactions were traded on the market, then all resources and satisfactions, including non-market work hours and utility, would be valued. With the rapid growth of the service industry in recent years, this is increasingly the case. As such, the time devoted to learning for the purposes of improving future efficiency in producing final satisfactions could also be classified as an investment.

Consistent with this approach, more studies examining the interaction between different outcomes, such as social, personal and economic outcomes, are needed. Assessing the complementarity and substitutability of different outcomes could improve efficiency and welfare. But most studies investigating the benefits of learning have focused on either economic or social outcomes and have rarely

examined multiple outcomes simultaneously to determine their reciprocal effects, if any. As cited, there have been recent efforts (for example, McMahon, 1999, 2001), but in general the research literature is parsimonious.

A separate issue concerns empirical applications of human capital theory. In general, research efforts into the benefits of learning have rarely considered the life-wide span of potential sources of knowledge and skills. Learning across the life-wide span is a theoretical concept classifying all learning as formal, non-formal or informal (Colletta, 1996), which has gained currency in recent years under the umbrella of lifelong learning. Most studies either focus on one form of learning or the other, and different forms of learning that span the life-wide learning spectrum are rarely considered simultaneously. As a consequence, the interactions between the different sources of knowledge and skills are often overlooked.

There is a growing concern and dissatisfaction with the econometric treatment of human capital theory. Most studies concerned with the economic benefits of learning either focus on initial schooling or job-related training. Formal education consistently emerges as the prime source of human capital investment for empirical analysis (Sweetland, 1996, p. 341). Considering that there is an imperfect correlation between education and skill (OECD & HRDC, 1997), empirical analyses focusing solely on formal education do not provide a complete picture.

Within the framework of Becker (1962, 1964) and Mincer's (1962) interpretation of human capital theory, however, there have been countless studies (for example, Barron *et al.*, 1989, 1997) that have investigated the economic benefits of job-related training. But relatively few studies have investigated the economic effects of informal learning, personal interest-related learning or learning outside the work context.

As a result of focusing on one form of learning vis-à-vis another, little is known about the relative influence that different learning activities exert on the process of forming one's knowledge and skills, and hence on different outcomes. There is also relatively little known about the substitutability and complementarity of learning taken for different reasons or that occurs in different contexts. Solow (2000, p. 154), for example, is struggling with the limited knowledge about how human capital is formed not only in school, but also at home via informal learning.

The web of causation between initial schooling, subsequent learning and, in turn, economic and social outcomes are potentially complex with significant confounding effects. Therefore, further in-depth analyses are needed to gain a greater understanding of the relationship between different learning activities. It is also important to examine the effects on different outcomes because it is conceivable that engaging in certain learning activities may have a negative impact on one outcome while maintaining a positive impact on the other. If this would be the case, then it would become important to identify these learning activities to avoid under-investment or over-investment in certain learning activities or learning that occurs in different contexts.

Accordingly, the purpose of the present article is to present a conceptual framework and a corresponding structural model to measure the relative effects of various learning activities on both economic and social outcomes. The article seeks a broader approach to examining the determinants of the economic and social benefits of learning by simultaneously considering different learning indicators that draw on each of the learning dimensions (i.e., formal, non-formal and informal).

The Model

In general, initial formal schooling potentially acts as a significant source of knowledge and skills. Thus, it follows from the theory of human capital (for example, Schultz, 1961; Becker, 1962, 1964, 1993; Mincer, 1962, 1974), and the theory of socialization (Sturman, 1997), that schooling may significantly generate both economic and social benefits by facilitating the acquisition of knowledge and skills. Furthermore, schooling can also play an important role in developing peoples' readiness to learn throughout their adult life. As a consequence, the effect of schooling on well-being is twofold. In addition to facilitating the acquisition of skills, it can also generate benefits by leading people to further acquire knowledge and skills through subsequent learning. Figure 1 presents a model that seeks to illustrate the twofold effect that schooling may have on both economic and social outcomes. The model presented is the hypothesized causal structure that is modified to empirically examine the effects of initial schooling on different outcomes.

Figure 1 shows a conceptual schema of the determinants of the economic and social outcomes of acquiring knowledge and skills from a life-wide learning perspective. There is an implicit time-related hypothesis in the structure. It is assumed that adult non-formal and informal learning occurs subsequent to formal learning. The assumption is due in part to data limitations. Formal learning indicators such as years of schooling and educational attainment are stock measures that are readily available. But most non-formal learning indicators, such as adult education and training taken for job-related reasons and personal interest-related reasons, are available as flow measures that are not cumulative. As a consequence, the model should be interpreted as the causation of initial formal learning on flows of subsequent learning and, in turn, their effects on outcomes. It should be noted that even though there are no cumulative measures of non-formal or informal learning, Tuijnman (1991) finds that there are strong predictive and cumulative tendencies inherent in adult education and training over time.

There are two central hypotheses underlying the structure of the model presented. First, initial schooling plays a role in developing skills, which in turn has an effect on economic and social outcomes. This hypothesis is based solely on the human capital theory (Schultz, 1961; Becker, 1962, 1964, 1993; Mincer, 1962, 1974). Second, initial schooling plays a role in leading people to engage in subsequent learning, which in turn plays a role in further developing and sustaining skills and, as such, affecting outcomes. This hypothesis is based on a combination of human capital theory and the notion that schooling plays a role in developing adults' readiness to learn. If it is the case that schooling credentials facilitate access to learning in a work context, it can also be added that the screening hypothesis (Arrow, 1973; Spence, 1973) plays a role in the model. But the focus of the model presented remains that subsequent learning will add to human capital, and, in turn, affect outcomes.

The intermediating variables in the model—such as, in this case, non-formal learning, informal learning and skills—can mediate the effect of initial schooling on outcomes. That is, the effect of schooling on outcomes can occur through these variables and, when it does, it is said that these variables are intermediate variables that mediate the effect of schooling on outcomes. Schooling can still have a separate direct effect on outcomes, but this is not illustrated in the generalized causal structure presented in Figure 1. In addition, the direct effect, if there would be any, could arise because other relevant intermediate variables are not specified in the

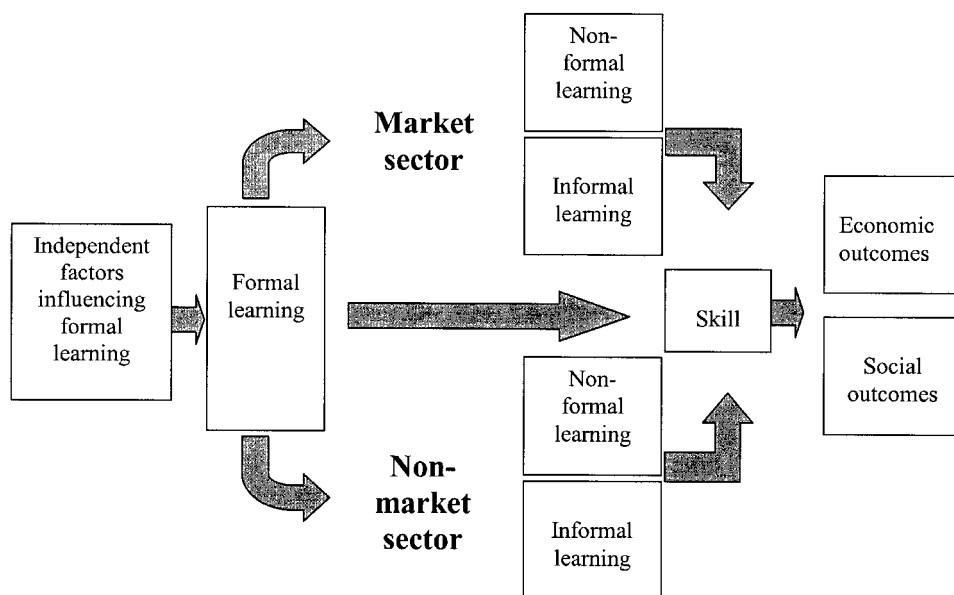


Fig. 1. The determinants of economic and social outcomes of acquiring knowledge and skills from a life-wide learning perspective.

model; for example, other skills that are not captured by the available measures of human capital.

In this model, the set of intermediate variables hypothesized to mediate the effects of initial schooling on economic and social outcomes span the life-wide perspective of learning, and are separated into learning associated with the market and the non-market sectors of the economy. Learning for the market sector refers to learning undertaken for job-related reasons or in a job-related context, whereas learning for the non-market sector refers to learning undertaken for personal interest-related reasons and in non-job-related contexts such as home or libraries.

Furthermore, all the indicators of learning are hypothesized to play a role in developing and sustaining skills, which in turn have an effect on outcomes. As such, skills are mediating the effect of all learning on outcomes. To the extent that this is occurring in the model of economic outcomes, it would provide support to the theory of human capital.

Modifying the generalized model presented in Figure 1 into a more complex structural model with additional variables and using Linear Structural Relations (LISREL) analysis, the causal structure is empirically tested. The results of the analysis are used to explicitly examine the hypothesis that subsequent learning significantly mediates the effect of initial schooling on both economic and social outcomes.

Evidence for this hypothesis would provide support to the idea that schooling plays a role in preparing adults to further engage in learning. In addition, it would also suggest that non-formal and informal learning indicators also play an important role in explaining outcomes. This would signal the need to develop reliable learning indicators that span the life-wide spectrum and to include them in more sophisticated applications of the human capital theory.

Such evidence would also suggest that there is a complex interaction between different learning activities, and thus would signal a need to further investigate these relationships in order to gain a greater understanding of the role of different learning activities in generating benefits. Moreover, in assessing the hypothesis, the extent and relative influence of the various learning activities on both economic and social outcomes are also reported. This enables one to observe whether different learning activities affect economic and social outcomes differently. A brief summary of previous research findings that lend support to the hypothesized causal structure is now outlined.

Previous Research

The causal effect of education on economic benefits has been investigated in hundreds of studies. There is much evidence to support indicators of formal education, such as years of schooling and level of educational attainment, having a positive and significant effect on individual earnings (for example, Psacharopoulos, 1973, 1981, 1985, 1994). Cohn and Addison (1998) provide a selective review of evidence from other recent international studies, and Card (1999) provides a broad overview of the theoretical issues and a selective review of new and innovative empirical studies. Despite some of the evidence, the mechanisms explaining the effect and the magnitude remain controversial. Is it the human capital theory?—which states that, under neoclassical assumptions, the increased productivity reflected through increased earnings is the result of acquiring more knowledge and skills. Or is it the screening theory?—which states that there is a credential effect associated with schooling that acts as a market signal to achieve a better and more efficient allocation in the labour market, whereby more able and hence more productive workers are correctly matched with relatively higher paying jobs. It is likely that the mechanisms are a combination of the two theories. Furthermore, are current levels of investment in education justified?

Many studies have investigated the social and other non-monetary benefits of education (Behrman and Stacey, 1997). But this research literature is parsimonious relative to the research on the economic benefits of education. McMahon (1997, 1998) conceptually identifies both the monetary and non-monetary benefits of education and learning, including the social benefit externalities. Wolfe and Zuvekas (1997) provide a selective review of studies investigating the non-monetary returns to education. Furthermore, Haveman and Wolfe (1984) conduct a landmark study estimating the non-monetary returns to education. Their estimates suggest that the non-monetary returns are approximately equivalent to the monetary returns. This would suggest that high levels of investment in education are justified.

The focus of most of these studies, however, is on the benefits of formal education. Tuijnman (1989) extends this by investigating the effect of recurrent education, which can in some situations be considered non-formal learning, on personal and psychological well-being. Other studies such as Hodgkinson and Weitzman (1988) have shown that formal education increases the likelihood of participating in volunteer activities and organizations. Their evidence suggests that schooling increases charitable giving, in terms of both volunteer time and financial donations. This finding supports the socialization theory of education, which suggests that education has a positive effect on social well-being by encouraging individuals to be a part of society (Sturman, 1997).

Some research investigating the effect of initial formal education on the likelihood of engaging in further learning activities provides further support to the causal structure presented in Figure 1. These findings are also interpreted to support the hypothesis that schooling plays an important role in preparing adults to engage in further learning. It is well documented that there is a substantial positive correlation between indicators of formal education (i.e., years of schooling and level of educational attainment) and adult education and training (for example, Johnstone & Rivera, 1965; Boshier & Collins, 1983). In addition, the work of Mincer (1974, 1984, 1993) suggests that learning through experience on the job and learning through experience in household production during hours not in the labour market is highly correlated with prior formal schooling. Results for Canada presented in Livingstone (2000, p. 6) suggests that those with higher levels of schooling tend to participate more in further learning opportunities such as adult education, workshops or some other form of organized learning. In the OECD and HRDC (1997) report, there is supporting evidence for 12 OECD countries suggesting that one's level of educational attainment has a positive and significant effect on the likelihood of participating in adult education and training. Comparatively few studies, however, have separated adult education and training taken for job-related reasons or personal interest-related reasons, as is done for this analysis. From data used in this analysis, both types of learning appear to be independent (see Table A1). Moreover, there is a positive bivariate correlation between adult education and training and formal education taken for either reason (see Table A1).

The evidence on the relationship between initial schooling and informal learning is mixed, however. The results presented in Livingstone (2000, p. 10) suggests that there is no relationship between one's level of schooling and the average number of hours per week one spends on learning informally. This contradicts the hypothesis that schooling plays a role in preparing adults to engage in further learning. But the reported findings are highly aggregated by using an all-inclusive measure of informal learning. They include informal learning projects undertaken for employment-related, household work-related, and general interest-related reasons. Moreover, the household work-related informal learning includes cooking and cleaning as informal learning. Other studies (for example, Tough, 1979) based on similar all-inclusive approaches to measuring informal learning have also observed a tendency for more variation within social groupings than between them (Livingstone, 2000). This is not surprising when learning activities that are common to most individuals, such as cooking and cleaning, are included, since this will significantly reduce the variability among different groupings. The measures of informal learning used in this analysis are limited to the intensity of engaging in literacy-related activities at work or in a home context. These measures are not claimed to be all-inclusive measures of informal learning, but are nevertheless used to indicate informal learning activities deemed to be relevant to economic and social benefits. Related to these indicators of informal learning, using data from the National Adult Literacy Survey, Smith (1996, p. 203) presents results suggesting that the number of print contents read is positively associated with one's level of education. Furthermore, the OECD and HRDC (1997) report findings from the International Adult Literacy Survey (IALS) suggesting that schooling is positively associated with literacy practice, both in a work and home context.

The hypothesis that all learning plays a role in developing and sustaining the skills embodied in individuals is inherent in the human capital paradigm. Of particular interest to this study are literacy skills as defined in Murray *et al.* (1998),

which are taken as indicators of general human capital. These are the direct measures of skills available in the IALS, which is the source of data used for the analysis presented in the current article. Formal education, adult education and training and literacy practice at home and at work are all reported to be positively associated with literacy skills (OECD & HRDC, 1997; OECD & Statistics Canada, 2000). Moreover, there is diverse research, that suggests practice at literacy activities (e.g., reading and writing) promotes literacy skill development (Smith, 1996, p. 199).

With respect to the effect of skills on outcomes, there is a strand of literature suggesting that inadequate literacy skills—taken as an indicator of general skills—reduce an individual's employment prospects and limit one's opportunity to participate fully in society (for example, Power, 1983; Centre for Educational Research and Innovation, 1992; OECD & Statistics Canada, 1995, 2000; OECD & HRDC, 1997). This literature implies that literacy skills may have a positive effect on both economic and social outcomes.

Related to the theoretical background of the causal structure presented in Figure 1 are the household production function approaches conceived by Becker (1965) and Ben Porath (1967). Ben Porath (1967) conceptualizes and develops a model concerning the production of human capital in a home context, which is similar to the learning associated with the non-market sector. Becker (1965) conceptualizes and models the use of non-market hours by households to produce final satisfactions. This is consistent with devoting time to learning in the home context for the purposes of achieving economic and social benefits.

Other related research includes Kendrick's (1976, p. 55) concept of 'Total Capital'. He defined personal outlays that could lead to learning in an informal context, such as consumer costs for libraries, museums and books as investments. Finally, the analysis presented is similar to the work of McMahon (1999, 2001), who also attempts to separate out the direct and indirect effects of education. However, his analysis is based on a time-series approach, whereas due to the nature of the data used in this analysis a cross-sectional approach is used. Moreover, the analysis presented in the current article focuses on the indirect effects of initial schooling on outcomes via subsequent learning. But McMahon (1999, 2001) focuses on the indirect effects of education via its effect on non-monetary benefits.

Data, Method and Variables

Data

The data source used for this analysis is the Canadian data of the IALS (1994–1998). The IALS was a 21-country cross-sectional literacy assessment of nationally representative samples of the adult population aged 16–65 years. The sample used in this article is restricted to the Canadian adult population aged 25–55 years.

The IALS data set provides unique direct measures of literacy skill. These measures provide an opportunity to assess the determinants of earnings and participating in volunteer or community organizations using literacy skills as an intermediate outcome of investing in various learning activities. The IALS study defines literacy in terms of a mode of adult behaviour—to use printed and written information to function in society (Murray *et al.*, 1998)—and, as such, indicates

skills that are needed to master daily life tasks. The direct measures of literacy skill are thus good indicators of general skills.

Statistical Method

The causal structure specified in Figure 1 is empirically estimated with the LISREL approach using the maximum likelihood fit function. A brief presentation of the LISREL model is provided here, but for a summary of theories guiding the application of LISREL, see Jöreskog and Sörbom (1990). For a full derivation of the LISREL model, see Jöreskog (1969).

The full LISREL model is defined by three equations:

$$\text{Structural equation model: } \eta = B\eta + \Gamma\xi + \zeta \quad (1)$$

$$\text{Measurement model for } y: y = \Lambda_y\eta + \varepsilon \quad (2)$$

$$\text{Measurement model for } x: x = \Lambda_x\xi + \delta \quad (3)$$

with the assumptions:

1. ζ is uncorrelated with ξ
2. ε is uncorrelated with η
3. δ is uncorrelated with ξ
4. ζ , ε and δ are mutually uncorrelated
5. $I-B$ is non-singular.

The random vectors $\eta' = (\eta_1, \eta_2, \dots, \eta_m)$ and $\xi' = (\xi_1, \xi_2, \dots, \xi_n)$ represent the latent dependent and independent variables, respectively, and thus are not observed. Instead, vectors $y' = (y_1, y_2, \dots, y_p)$ and $x' = (x_1, x_2, \dots, x_q)$ represent the dependent and independent observed variables, respectively. Vectors $\varepsilon(1 \times p)$ and $\delta(1 \times q)$ represent the measurement errors associated with the latent variables. Vector $\zeta(1 \times m)$ represents the random disturbances inherent in the structural equations. Matrices $\Lambda_y(q \times m)$ and $\Lambda_x(p \times n)$ represent the parameters of the dependent and independent measurement models, respectively. Finally, matrices $B(m \times m)$ and $\Gamma(m \times n)$ represent the dependent and independent parameters of the structural model, respectively.

Most variables of interest in the social sciences can only be estimated using indicators (or proxies), and thus there usually is substantial measurement error in the variables of interest. Despite the fact that it is generally known that the data are imperfect, this is commonly overlooked (Tuijnman & ten Brummelhuis, 1992). Theoretical variables using latent constructs allow the researcher to address some of these problems. One advantage of using the LISREL approach is that it takes the measurement error of theoretical variables into account when estimating the structural relationships among variables by allowing the use of latent constructs.

Inherent in the LISREL approach is a combination of confirmatory factor analysis used to estimate latent variables and multiple linear regression analysis to estimate the structural relationships among these variables. Note that latent variables are only estimated when there is more than one observed variable indicating the same theoretical concept (see Table 1). Before designating observed variables to theoretical variables (i.e., constructing the measurement model), an exploratory factor analysis using principal components analysis is performed to

Table 1. Descriptions, symbols and designations of observed to theoretical variables

Theoretical variable, ξ	Observed variable, X	N
<i>Independent variables</i>		
ξ_1 -Home background (HBG)	X_1 -Father's educational attainment (FED)	2395
	X_2 -Mother's educational attainment (MED)	2333
	X_3 -Father's two-digit SOC (FOC)	2614
ξ_2 -Experience (EXP)	X_4 -Age minus years of education minus five (EXP)	2731
ξ_3 -Non-native language status (NNL)	X_5 -Non-native language status (LAN)	2731
ξ_4 -Gender (GEN)	X_6 -Gender (MF)	2731
Theoretical variable, η	Observed variable, Y	N
<i>Dependent variables</i>		
η_1 -Formal learning (FL)	Y_1 -Highest level of education completed (LEV)	2730
	Y_2 -Years of schooling (YRS)	2730
η_2 -Labour force participation (LFP)	Y_3 -Labour force participation (LP)	2730
η_3 -Knowledge-intensity of occupation (KNO)	Y_4 -Classification of four-digit SOC (SOC)	2218
η_4 -Non-formal job-related learning (JRN)	Y_5 -Participation in job-related adult education and training (PJR)	2731
η_5 -Informal job-related learning (JRI)	Y_6 -Intensity of writing letters or memos at work (W1)	2212
	Y_7 -Intensity of reading articles or reports at work (RW)	2212
	Y_8 -Intensity of writing articles or reports at work (W2)	2212
η_6 -Informal personal interest-related learning (PRI)	Y_9 -Intensity of reading books at home (RH)	2721
	Y_{10} -Intensity of writing letters at home (WH)	2721
	Y_{11} -Frequency of visits to library (LIB)	2723
η_7 -Personal-interest adult education (PRN)	Y_{12} -Participated in personal interest-related adult education and training (PPR)	2731
η_8 -Skill (SKI)	Y_{13} -Quantitative literacy (QUA)	2731
	Y_{14} -Document literacy (DOC)	2731
	Y_{15} -Prose literacy (PRO)	2731
η_9 -Economic outcomes (EO)	Y_{16} -Annual earnings from wages and salaries in 1993 (EAR)	2368
η_{10} -Social outcomes (SO)	Y_{17} -Frequency of participating in volunteer or community organizations (COM)	2732

Note: The variables ξ and η are measured as latent constructs only when there is more than one observed variable available to indicate the theoretical variable. Otherwise the theoretical variable is the same as the observed variable. In this model, there is one latent ξ and four latent η variables.

select or exclude observed variables with confounded measurements. After specifying the measurement model, the structural model is formed by specifying the structural relationships among the latent variables.

Variables

Table 1 provides a summary description of the theoretical and observed variables used in the analysis. It also demonstrates how various observed variables are designated to the corresponding theoretical variables specified in Figure 1.

All observed variables are derived from the Canadian Adult Literacy Survey (1994) and are used to empirically estimate the measurement and structural model. The various learning activities considered span the life-wide spectrum of learning. Empirically, a variety of different learning indicators are classified into each learning dimension as follows: level of educational attainment and years of schooling correspond to formal learning; job-related adult education and training and personal interest-related adult education correspond to job-related and personal interest-related non-formal learning, respectively; and, literacy practice at work and literacy practice at home correspond to job-related and personal interest-related informal learning, respectively. The informal learning variables denote the intensity with which an individual engages in various literacy-related activities. The job-related informal learning is measured as a latent construct using indicators of the intensity of engaging in the following learning activities as part of their main job: read or use manuals, reference books, including catalogues; write or fill-out letters or memos; and write or fill-out reports or articles. The personal-interest-related informal learning is measured as a latent construct using indicators of the intensity of engaging in the following learning activities at home: reading books, writing letters or anything else that is more than one page in length, and use of a public library. The observed variables are not claimed to be all-inclusive measures of the theoretical variables. But the theoretical labels are used when presenting the analysis to illustrate that the learning indicators used for the analysis span the life-wide learning spectrum, as well to acknowledge that some of the measurement errors associated with the observed variables are explicitly taken into account.

A few comments about the available learning variables, which are selected to indicate the theoretical concept of life-wide learning, are worth noting. The classification scheme in this analysis uses the '*Classification of Learning Activities used for the German Time Use Survey 2001/2002*' outlined in *The Report of the Eurostat Task Force on Measuring Lifelong Learning* (Eurostat, 2001) as a guideline for differentiating between formal and non-formal learning indicators. The scheme does not necessarily correspond with formal vis-à-vis non-formal education definitions in the academic literature, but for statistical measurement purposes and data limitations this is the scheme used for the analysis presented in the current article. Adult education and training is taken to be an indicator of non-formal education, but it could be argued that certain adult education courses belong to the formal dimension of learning. The guidelines for the '*Classification of Learning Activities used for the German Time Use Survey 2001/2002*', however, also suggest that formal courses taken by non-formal students could be classified as non-formal education (Eurostat, 2001). Assuming that adults aged 25–55 years are non-formal students, the classification is consistent with the scheme presented in Eurostat (2001). But a separate technical reason for the use of this scheme is that the IALS data does not

have a cumulative measure of adult education and training, and as a consequence it is not possible to reconcile one flow of formal adult education and training with the stock measures of initial formal schooling that are used in the analysis. These are two reasons for designating the observed variables to the theoretical concepts of life-wide learning as it is done in Table 1.

As mentioned, the outcomes considered are separated between economic and social outcomes. The corresponding indicators are annual earnings from wages/salaries and the intensity of participating in volunteer or community organizations, respectively. Furthermore, there are four independent factors known to be associated with formal learning that are included in the model. These independent factors are age, home background, gender and non-native mother tongue status.

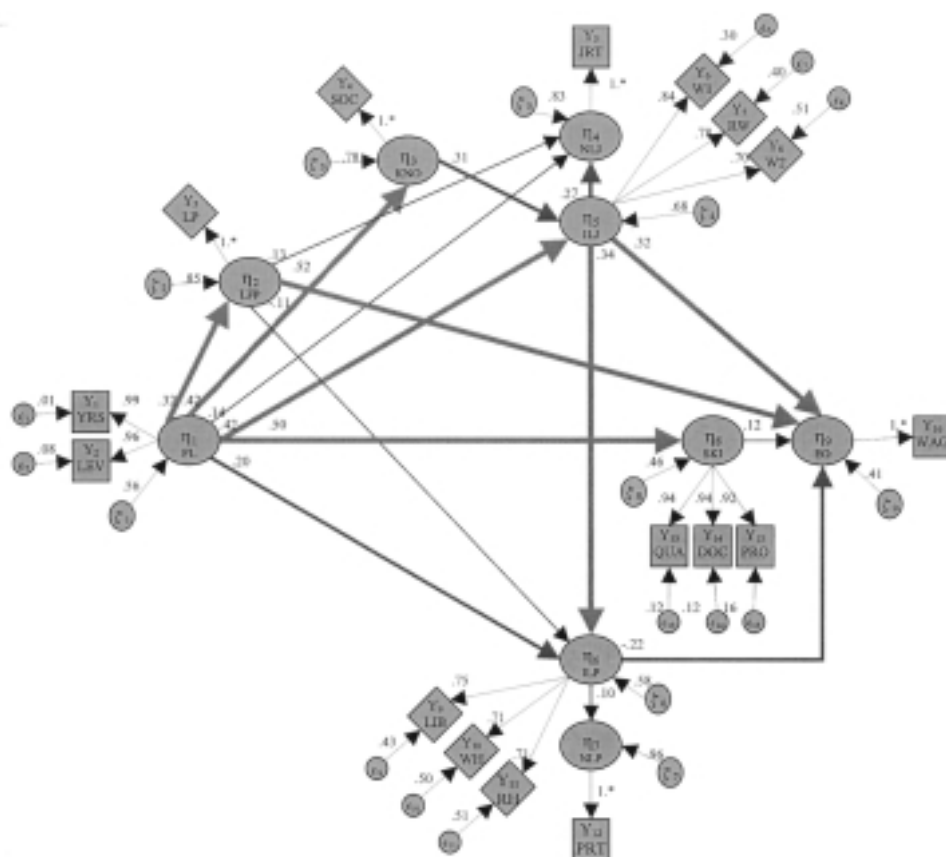
Other variables pertaining to the structure of learning associated with the market sector are also specified in the empirical model. These are the labour force status and the knowledge-intensity of one's occupation. Participating in the labour market may have a significant impact on one's earnings and it is also likely to affect the intensity of participating in volunteer or community organizations. The knowledge-intensity of one's occupation is believed to have a significant impact on the informal and non-formal learning that is associated with the market sector. In particular, it should affect reading practice at work, which are the informal learning indicators used in the analysis. Following the 'use-it-or-lose-it' hypothesis (Krahn & Lowe, 1998), engaging in literacy practice at work should develop and sustain skills and, in turn, affect outcomes through the human capital hypothesis.

Empirical Results

Two separate models are fitted to the data, each using the same 12-predictor variables to explain the variance in economic and social outcomes. There are four independent and eight dependent predictors in each model. One model aims to explain the variance in annual earnings from wages and salaries, and the other aims to explain the variance in the intensity of participating in volunteer or community organizations. The estimation results of the models quantify the extent and relative influence of the total, direct and indirect effects of various learning activities on outcomes.

Figures 2 and 3 graphically present the standardized maximum likelihood regression weights for the dependent structures of the economic and social outcomes model, respectively. A standardized maximum likelihood solution allows for comparisons to be within across the two models estimated. Both the measurement and structural models are presented in each figure. In Figures 2 and 3, the observed variables ($y_1, y_2, \dots, y_{17}$) are depicted by squares, which make up the measurement model.

Similarly, the dependent latent variables ($\eta_1, \eta_2, \dots, \eta_{10}$) are depicted by circles, and the relations specified among them make up the structural model. The independent observed and latent variables are not shown in the figures. See Tables A2 and A3 for a complete standardized maximum likelihood solution with standard errors and t values for both the economic and social outcomes models estimated, respectively. Furthermore, Table A4 presents the dependent and independent measurement models, which are the same for both estimated models.



Notes: (a) Standardized maximum likelihood (ML) solution. (b) Table A3 presents the full ML solution with t-values. (c) Structural paths less than 0.10 that are significant at the five percent level are not shown in the figure but presented in Table A3. (d) Table 3 presents fit statistics for the model.

(d) Independent variables are not shown in the figure but presented in Table A3 with t-values.

* indicates a fixed parameter

η_1 indicates formal learning (FL);

η_2 indicates labor force participation (LFP);

η_3 indicates knowledge intensity of occupation (KNO);

η_4 indicates non-formal job-related learning (NLR);

η_5 indicates informal job-related learning (ILJ);

η_6 indicates informal personal-interest-related learning (ILP);

η_7 indicates non-formal personal-interest related (NLP);

η_8 indicates skill (SK);

η_9 indicates economic outcomes (EO);

Y_1 denotes highest level of formal schooling completed (LEV);

Y_2 denotes years of formal schooling (YRS);

Y_3 denotes labour force participation (LFP);

Y_4 denotes 4-digit occupation code (SOC);

Y_5 denotes participation in job-related adult training (JRT);

Y_6 denotes intensity of writing memos or letters at work (W1);

Y_7 denotes intensity of reading reports or articles at work (RW);

Y_8 denotes intensity of writing reports or articles at work (W2);

Y_9 denotes frequency of attending a library (LIB);

Y_{10} denotes intensity of writing letters at home (WH);

Y_{11} denotes intensity of reading books at home (RH);

Y_{12} denotes participation in personal-related adult education (PRE);

Y_{13} denotes proficiency in quantitative literacy (QUA);

Y_{14} denotes proficiency in document literacy (DOC);

Y_{15} denotes proficiency in prose literacy (PRO);

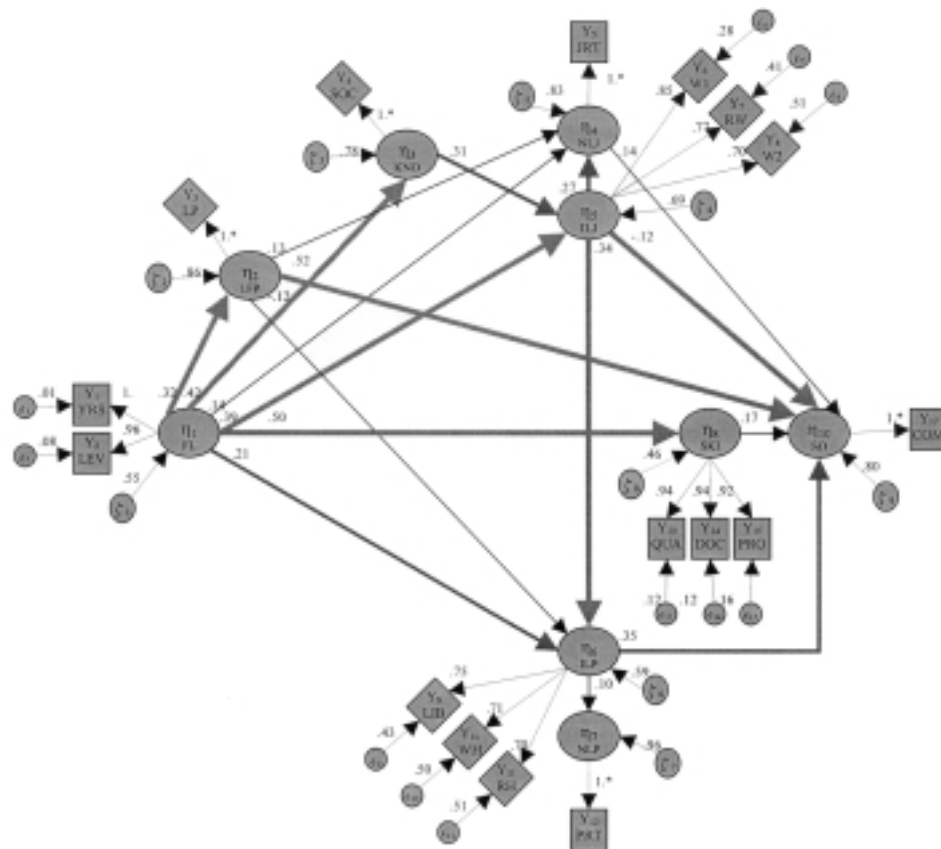
Y_{16} denotes annual wages and salaries (WAG).

Source: Canadian Adult Literacy Survey, 1994.

Fig. 2. Structural and measurement parameter estimates for the dependent structure in a model of economic outcomes for adults aged 25–55 years in Canada, 1994.

It is convenient to differentiate the strength of the paths in the structure when visually presenting the results. Table 2 classifies the standardized regression weights as a very strong effect, strong effect, moderate effect, weak effect, or a not statistically significant effect. These effects are only relevant to the structural model and not to the measurement model.

Table 3 summarizes the fit of the economic and social outcomes models. According to the goodness-of-fit and root mean square residual indices, it appears



Notes: (a) Standardized maximum likelihood (ML) solution. (b) Table A4 presents the full ML solution with t-values. (c) Structural paths less than 0.10 that are significant at the five percent level are not shown in the figure but presented in Table A4. (d) Table 3 presents the fit statistics for the model. (e) Independent variables are not shown in the figure but presented in Table A4 with t-values.

* indicates a fixed parameter

η_1 indicates formal learning (FL);
 η_2 indicates labor force participation (LFP);
 η_3 indicates knowledge intensity of occupation (KNO);
 η_4 indicates non-formal job-related learning (NFLJ);
 η_5 indicates informal job-related learning (ILJ);
 η_6 indicates informal personal-interest-related learning (ILP);
 η_7 indicates non-formal personal-interest related (NLP);
 η_8 indicates skill (SKL);
 η_9 indicates social outcomes (SOC);
 η_{10} denotes highest level of formal schooling completed (LEV);
 η_{11} denotes years of formal schooling (YRS);
 η_{12} denotes labour force participation (LFP);
 η_{13} denotes 4-digit occupation code (SOC);

Y_1 denotes participation in job-related adult training (JRT);
 Y_2 denotes intensity of writing memos or letters at work (WF1);
 Y_3 denotes intensity of reading reports or articles at work (RW1);
 Y_4 denotes intensity of writing reports or articles at work (W2);
 Y_5 denotes frequency of attending a library (LIB);
 Y_6 denotes intensity of writing letters at home (WH);
 Y_7 denotes intensity of reading books at home (RH);
 Y_8 denotes participation in personal-related adult education (PRT);
 Y_9 denotes proficiency in quantitative literacy (QUA);
 Y_{10} denotes proficiency in document literacy (DOC);
 Y_{11} denotes proficiency in prose literacy (PRO);
 Y_{12} denotes frequency of participating in volunteer or community organizations (COM).

Source: Canadian Adult Literacy Survey, 1994.

Fig. 3. Structural and measurement parameter estimates for the dependent structure in a model of social outcomes for adults aged 25–55 years in Canada, 1994.

that both models have an acceptable fit to the data. The common rule for the goodness-of-fit is that if it exceeds 90%, then the model is said to fit the data and is acceptable (Hoyle & Panter, 1995; Tuijnman & Keeses, 1997). Moreover, the root mean square residual should lie below 0.05 for an acceptable fit of the model (Tuijnman & Keeses, 1997).

Table 4 presents the standardized maximum likelihood regression weights for each predictor variable. The total effects (TE) of each predictor are decomposed

Table 2. Classification of standardized regression weights (RW)

Regression weight	Scale	Symbol
$RW \geq 0.30 $	Very strong effect	→
$ 0.20 \leq RW < 0.30 $	Strong effect	→
$ 0.10 \leq RW < 0.20 $	Moderate effect	→
$RW < 0.10 $	Weak effect	Not indicated
$RW = 0$	$p > 0.05$	*

into direct effects (DE) and indirect effects (IE). The decomposition of the total effect is derived as follows:

$$TE_i = DE_i + IE_i \quad (4)$$

$$IE_i = \sum_{j=i+1}^{m-1} DE_i(\eta_j) \times TE_j(\eta_m) \quad (5)$$

The indirect effect of the i th variable on the m th occurs as a result of the mediating effects that the intermediate variables have between them ($i + 1$ through $m-1$). For example, in Figure 3 there is no path between formal education (variable i) and social outcomes (variable m), but formal education exerts a significant and positive effect on social outcomes through other intermediating variables (variables $i + 1$ through $m-1$). Therefore, it is said that the effect of formal education on social outcomes is entirely mediated by the intermediate variables between them, and is also referred to as an indirect effect.

The indirect effects of formal education on outcomes reported in Table 4 are further decomposed in Table 5 for both economic and social outcomes. These are simply the individual elements of equation (5), which are reported individually for each intermediate variable (i.e., variables $i + 1$ through $m-1$).

Discussion of Results

The results summarized in Figure 4a report the total effects of various types of learning activities on indicators of economic and social outcomes. The presentation conveniently depicts the relative influence of various learning activities on outcomes. It shows that formal learning has the strongest relative influence on

Table 3. Fit statistics for two models, economic and social outcomes, for adults aged 25–55 years in Canada, 1994

Model fit	Economic outcomes	Social outcomes
Explained variance	0.590	0.205
Root mean square residual	0.040	0.040
Goodness-of-fit index	0.908	0.908

Source: Canadian Adult Literacy Survey, 1994.

Table 4. Standardized maximum likelihood regression weights for the total, direct and indirect effects of 12 predictors on economic and social outcomes, for adults aged 25–55 years in Canada, 1994

	Economic outcomes			Social outcomes		
	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect
<i>Independent predictors</i>						
Gender	0.332	0.130	0.201	–0.032***	0.051	–0.083
Non-native mother tongue	–0.160	–0.066	–0.094	–0.134	–0.114	–0.020**
Home background	0.106	*	0.106	0.181	*	0.181
Age	0.002***	0.044	–0.041	0.032***	0.109	–0.076
<i>Dependent predictors</i>						
Formal learning	0.397	0.058	0.342	0.232	*	0.232
Labour force participation	0.552	0.514	0.038	0.058	0.069	–0.011**
Knowledge-intensity of occupation	0.078	*	0.078	0.010***	*	0.010**
Informal job-related learning	0.258	0.318	–0.060	0.059	–0.123	0.182
Non-formal job-related learning	0.027***	0.037	–0.010	0.174	0.141	0.034
Informal personal-interest related learning	–0.221	–0.221	0.000	0.365	0.346	0.019
Non-formal personal-interest related learning	–0.081	–0.081	**	0.074	0.074	**
Skill	0.123	0.123	**	0.172	0.172	**

* Direct effect not estimated: $p > 0.05$ not statistically significant.

** Indirect effect insignificant: $p > 0.05$ not statistically significant.

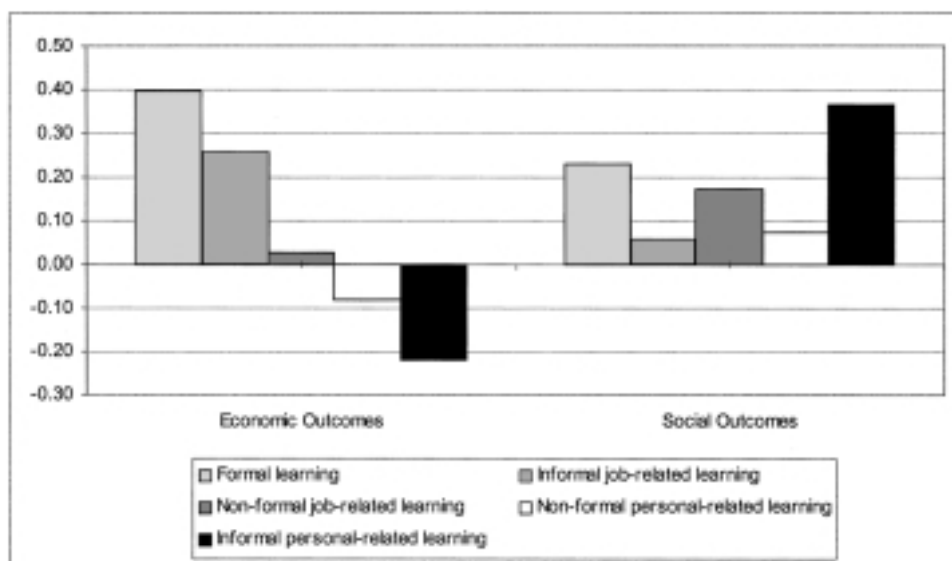
*** Total effect insignificant: $p > 0.05$ not statistically significant.

Source: Canadian Adult Literacy Survey, 1994.

Table 5. Decomposition of the indirect effect (standardized maximum likelihood regression weights) of formal learning on economic and social outcomes, for adults aged 25–55 years in Canada, 1994

	Economic outcomes	Social outcomes
Direct effect	0.058	–
Indirect effect	0.342	0.232
Total effect	0.397	0.232
<i>Decomposition of indirect effect</i>		
Labour force participation	0.178	0.019
Informal job-related learning	0.110	0.023
Skill	0.061	0.086
Knowledge-intensity of occupation	0.033	0.004
Non-formal job-related learning	0.004	0.024
Non-formal personal interest-related learning		
Informal personal interest-related learning	–0.043	0.075
Indirect effect	0.342	0.232

Source: Canadian Adult Literacy Survey, 1994.



Learning categories are ranked by the total effect on economic outcomes
Source: Canadian Adult Literacy Survey, 1994.

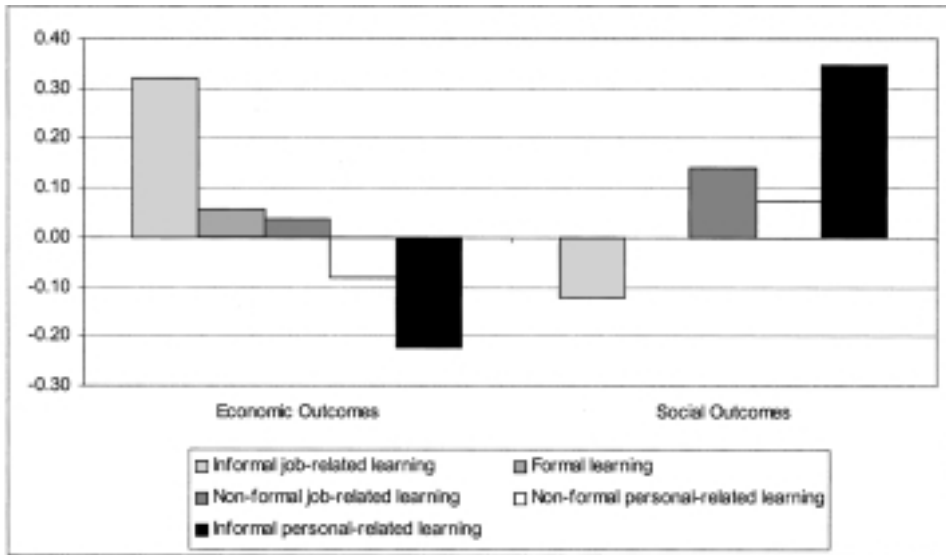
Fig. 4(a). Total effects (standardized maximum likelihood regression weights) of various types of learning activities on economic and social outcomes for adults aged 25–55 years in Canada, 1994.

economic outcomes, whereas informal personal interest-related learning has the strongest relative influence on social outcomes.

It should be noted that non-formal job-related learning only exerts a weak effect on economic outcomes because employer-sponsored training is not differentiated from non-employer-sponsored training. Therefore, the measure has confounding effects since unpaid job-related training has a negative effect on same period earnings flow relative to paid job-related training. Moreover, the influence that one expects non-formal job-related learning to exert on earnings is unlikely to be immediately realized within the same period.

It would appear from Figure 4a that personal interest-related learning exerts a negative effect on economic outcomes. But there is a complete reversal of this effect when considering social outcomes. In fact, informal personal interest-related learning exerts the strongest positive effect on social outcomes, and non-formal personal interest-related learning exerts a moderate effect. These findings demonstrate the importance of differentiating between economic and social outcomes. Moreover, the findings suggest that there may be a trade-off between learning for different reasons or in different contexts with respect to outcomes. This also demonstrates the importance of investigating multiple dimensions of adult learning.

Figure 4b reports the direct effects of various learning activities on economic and social outcomes. It appears that informal job-related learning has the strongest positive direct effect on economic outcomes, but a moderately negative direct effect on social outcomes. While, at the same time, informal personal interest-related learning has the strongest direct effect on social outcomes, but a strong negative direct effect on economic outcomes.



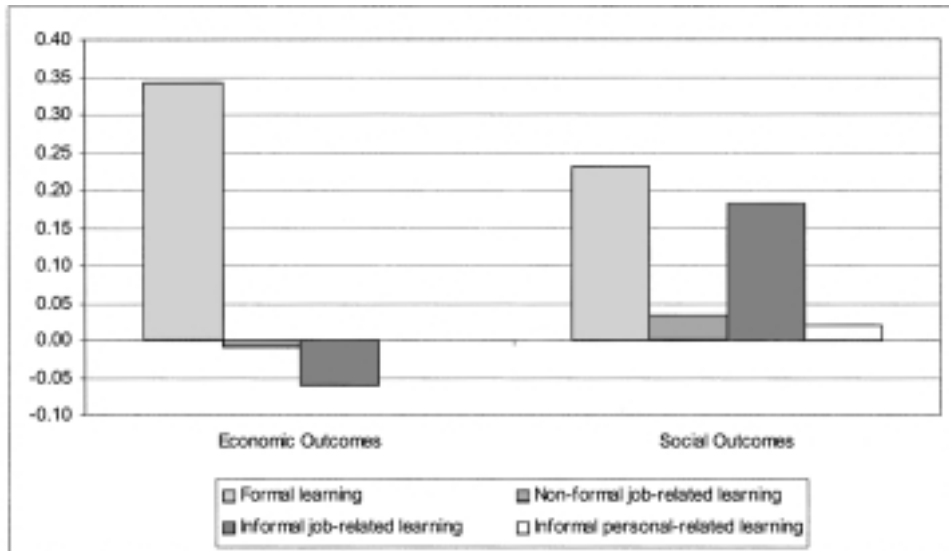
Learning categories are ranked by the direct effect on economic outcomes
Source: Canadian Adult Literacy Survey, 1994.

Fig. 4(b). Direct effects (standardized maximum likelihood regression weights) of various types of learning activities on economic and social outcomes for adults aged 25–55 years in Canada, 1994.

It also appears from Figure 4b that formal learning has a weak direct effect on economic outcomes and no direct effect on social outcomes. This result suggests that the intermediate variables included in the causal structure significantly mediate the effect of formal learning on outcomes. This implies that subsequent learning in adult life may play a significant role in determining outcomes. The finding also provides support to the hypothesis that initial formal learning positively affects adults' readiness to learn and, in turn, affects outcomes.

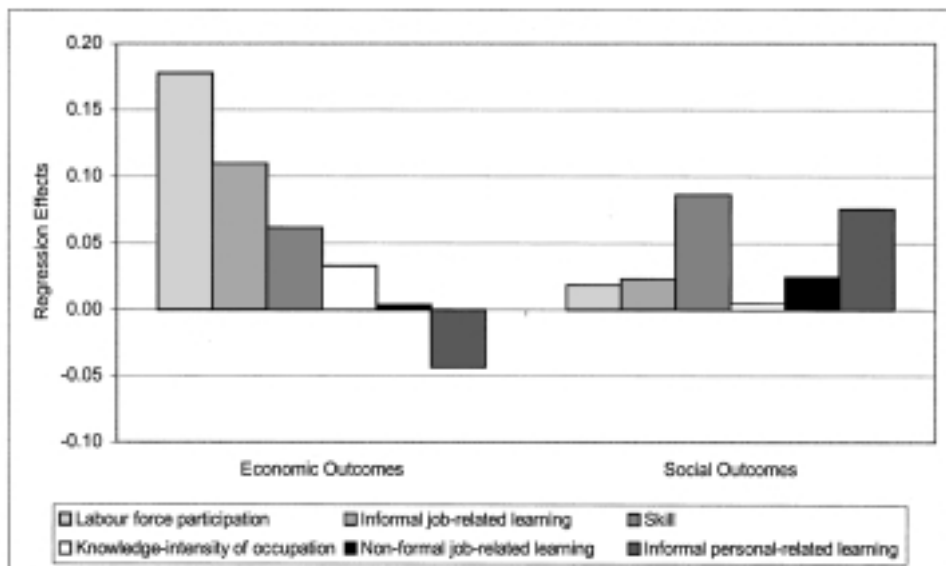
Figure 4c suggests that the indirect effects of non-formal and informal job-related learning on economic outcomes are negative. This is because learning for job-related reasons has a positive direct effect on learning for personal interest-related reasons. In turn, learning for personal interest reasons has a negative direct effect on economic outcomes. Thus it follows that the indirect effect of informal job-related learning is negative. In the case of social outcomes, the reverse happens. This is because learning for job-related reasons maintains its positive direct effect on learning for personal interest-related reasons. But, in this case, learning for personal interest reasons has a positive direct effect on social outcomes. Therefore, while informal learning for job-related reasons has a negative direct effect on social outcomes, it has a positive indirect effect via learning for personal interest-related reasons. These findings demonstrate that there is a complex interaction between different learning activities.

Figure 5 decomposes the indirect effect of formal learning on outcomes. This is to gain insight into the mediating effects that other types of learning activities have on the relationship between formal learning and outcomes. Labour force participation has the largest share of the indirect effect of formal learning on economic outcomes. This presumably follows from the increased likelihood of



Learning categories are ranked by the indirect effect on economic outcomes
Source: Canadian Adult Literacy Survey, 1994.

Fig. 4(c). Indirect effects (standardized maximum likelihood regression weights) of various types of learning activities on economic and social outcomes for adults aged 25–55 years in Canada, 1994.



Intermediating variables are ranked by the indirect effect on economic outcomes
Source: Canadian Adult Literacy Survey, 1994.

Fig. 5. Decomposition of indirect effects (standardized maximum likelihood regression weights) of formal learning on economic and social outcomes for adults aged 25–55 years in Canada, 1994.

participating in the labour force the higher one's level of educational attainment, which in turn exerts a positive effect on earnings.

The largest contributing factor to the indirect effect of formal learning on social outcomes is observed to be skills. The second is informal personal interest-related learning. Thus, formal learning plays an important role on social outcomes via the creation of skills and adults' readiness to learn informally for personal interest-related reasons. It should be re-iterated that the observed variables used to indicate informal personal-related learning are limited to home literacy practice in this analysis. Previous research with more inclusive measures of informal learning such as learning to cook and clean have noted contradictory findings; namely, that formal learning and informal learning are independent (Livingstone, 2000).

Skill also has a relatively high share of the indirect effect on economic outcomes, ranking as the third largest mediating effect next to labour force participation and informal job-related learning. The fourth largest—albeit weak—mediating effect on economic outcomes is the knowledge-intensity of occupations, suggesting that formal learning plays a role on economic outcomes by allowing individuals to gain access to well-paid and highly skilled occupations. Therefore, the results suggest that formal learning plays an important role on economic outcomes by inducing individuals to participate in the labour market, improving access to highly skilled occupations, engaging in more informal job-related learning and, in turn, developing and maintaining skills.

Conclusions

The results of the analysis presented in the current article provide support to the hypothesis that initial formal learning has a significant and positive impact on both economic and social outcomes. It is suggested, however, that the causal effect is much more complex than simply a direct effect. In particular, it appears that initial formal learning has a positive effect on subsequent learning activities, which in turn have effects on the economic and social outcomes investigated. This finding illustrates the significance of considering multiple dimensions of learning when investigating the benefits of education and, more broadly, the benefits of learning.

Such an approach reveals a potentially important finding. The results suggest that subsequent learning has confounding effects on different outcomes. Depending on the reason or the context in which the subsequent learning is undertaken, it may negatively mediate the effect of formal learning on economic (social) outcomes while at the same time having a positive mediating effect on social (economic) outcomes. This finding suggests a trade-off between promoting certain types of learning activities vis-à-vis others. It also highlights the significance of empirically investigating the effects of learning on multiple dimensions of well-being.

It is perhaps not surprising that informal personal interest-related learning has a negative effect on economic outcomes, since it diverts time and other resources away from work and the production process. But by considering a broader notion of well-being that includes social well-being, then the diverted resources maintain a positive effect on standards of living. This suggests that enacting policies, which promote learning for personal interest-related reasons, are desirable for social well-being. If social well-being in turn positively affects economic well-being, as suggested by the findings in McMahon (1999), such policies would also positively affect economic well-being in an indirect manner.

In modern advanced societies, the knowledge-intensity and skill-intensity of occupations is increasing and, as a consequence, more resources are being devoted to learning for job-related reasons or in job-related contexts. The findings suggest that if people devote less time to learning for personal interest-related reasons, there may be negative consequences for social well-being. At the same time, however, the findings also suggest that learning for job-related reasons positively affects learning for personal interest-related reasons, which in turn positively affects social well-being. Both of these findings signal the need for further empirical research that seeks to investigate the causal relationships between the multiple dimensions of learning and well-being.

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References

- Arrow, K. (1973) Higher education as a filter, *Journal of Public Economics*, 2, pp. 193–216.
- Barron, J. M., Black, D. & Loewenstein, M. (1989) Job matching and on the job training, *Journal of Labor Economics*, 7, pp. 1–19.
- Barron, J. M., Berger, M. C. & Blank, D. A. (1997) *On-the-Job Training* (Kalamazoo, MI, Upjohn Institute Employment Residence).
- Becker, G. (1962) Investment in human capital: a theoretical analysis, *Journal of Political Economy*, 70(5), pp. 9–49.
- Becker, G. (1964) *Human Capital: A Theoretical and Empirical Analysis, With Special Reference to Education* (New York, National Bureau of Economic Research).
- Becker, G. S. (1965) A theory of the allocation of time, *Economic Journal*, 75(299), pp. 493–517.
- Becker, G. S. (1993) *Human Capital: A Theoretical and Empirical Analysis With Special Reference to Education, Third Edition* (Chicago, IL, University of Chicago Press).
- Behrman, J. R. & Stacey, N. (1997) *The Social Benefits of Education* (Ann Arbor, MI, University of Michigan Press).
- Ben-Porath, Y. (1967) The production of human capital and the life cycle of earnings, *Journal of Political Economy*, 75(14), pp. 352–365.
- Boshier, R. W. & Collins, J. B. (1983) Education participation scale factor structure and socio-demographic correlates for 12,000 learners, *International Journal of Lifelong Education*, 2, pp. 163–177.
- Card, D. (1999) The causal effect of education on earnings, in: Ashenfelter, O. & Card, D. (Eds) *Handbook of Labor Economics, Vol. 3* (Amsterdam, Elsevier Science), pp. 1801–1863.
- Centre for Educational Research and Innovation (1992) *Adult Illiteracy and Economic Performance* (Paris, OECD).
- Colletta, N. J. (1996) Formal, nonformal, and informal education, in: Tuijnman, A. C. (Ed.) *International Encyclopaedia of Adult Education and Training, Second Edition* (Oxford, Pergamon Press), pp. 22–27.
- Cohn, E. & Addison, J. (1998) The economic returns to lifelong learning in OECD countries, *Education Economics*, 6(3), pp. 253–308.
- Eurostat (2001) *Report of the Eurostat Task Force on Measuring Lifelong Learning* (Brussels, European Commission). Available at: <http://forum.europa.eu.int/Public/irc/dsis/ceies/library>.

- Haveman, R. & Wolfe, B. (1984) Schooling and economic well being: the role of non-markets effects, *Journal of Human Resources*, 19, pp. 377–407.
- Hodgkinson, V. & Weitzman, M. (1988) *Giving and Volunteering in the United States: Findings from a National Survey, 1988 Edition* (Washington, DC, Independent Sector).
- Hoyle, R. H. & Panter, A. T. (1995) Writing about structural equations models, in: Hoyle, R. H. (Ed.) *Structural Equation Modeling: Concepts, Issues, and Applications* (London, Sage Publications), pp. 158–176.
- Johnstone, J. W. C. & Rivera, R. J. (1965) *Volunteers for Learning: A Study of the Educational Pursuits of American Adults* (Chicago, IL, Aldine).
- Jöreskog, K. G. (1969) A general approach to confirmatory maximum likelihood factor analysis, *Psychometrika*, 34(2), pp. 183–202.
- Jöreskog, K. G. & Sörbom, D. (1990) Linear structural relations analysis, in: Husen, T. & Postlewaite, T. N. (Eds) *The International Encyclopedia of Education, Supplementary Volume II* (Oxford, Pergamon Press), pp. 368–376.
- Kendrick, J. (1976) *The Formation and Stocks of Total Capital* (New York, Columbia University Press).
- Krahn, H. & Lowe, G. S. (1998) *International Adult Literacy Survey: Literacy Utilization in Canadian Workplaces* (Ottawa, Statistics Canada and Human Resources Development Canada).
- Lavoie, M. & Roy, R. (1998) *Employment in the Knowledge-Based Economy: A Growth Accounting Exercise for Canada* (Ottawa, Human Resources Development Canada).
- Livingstone, D. (2000) Exploring the icebergs of adult learning: findings of the First Canadian Survey of Informal Learning Practices. *NALL Working paper, No. 10–2000* (Toronto, Ontario Institute for Studies in Education, University of Toronto).
- Lucas, R. E. (1988) On the mechanics of economic development, *Journal of Monetary Economics*, 22(1), pp. 3–42.
- McMahon, W. (1997) Conceptual framework for measuring the total social and private benefits of education, *International Journal of Educational Research*, 27, pp. 453–479.
- McMahon, W. (1998) Conceptual framework for the analysis of the social benefits of lifelong learning, *Education Economics*, 6(3), pp. 309–346.
- McMahon, W. (1999) *Education and Development: Measuring the Social Benefits* (Oxford, Oxford University Press).
- McMahon, W. (2001) The impact of human capital on non-market outcomes and feedbacks on economic development (in OECD Countries), in: Helliwell, J. F. (Ed.) *The Contribution of Human and Social Capital to Sustained Economic Growth and Well-Being* (Paris, OECD), pp. 136–171.
- Mincer, J. (1962) On the job training: costs, returns and some implications, *Journal of Political Economy*, 70(2), pp. 50–79.
- Mincer, J. (1974) *Schooling, Experience and Earnings* (New York, Columbia University Press).
- Mincer, J. (1984) Human capital and economic growth, *Economics of Education Review*, 3, pp. 195–205.
- Mincer, J. (1993) *Collected Essays of Jacob Mincer, Volume I Studies in Human Capital* (Aldershot, J.K.).
- Murray, T. S., Kirsch, I. S. & Jenkins, L. B. (1998) *Adult Literacy in OECD Countries: Technical Report on the First International Adult Literacy Survey* (Washington, DC, National Centre for Education Statistics).
- OECD (2001) *The Well-Being of Nations: The Role of Human and Social Capital* (Paris, OECD).
- OECD & HRDC (1997) *Literacy for the Knowledge Society: Second Report of the International Adult Literacy Survey* (Paris and Ottawa, OECD and HRDC).
- OECD & Statistics Canada (1995) *Literacy, Economy and Society: Results of the First International Adult Literacy Survey* (Paris and Ottawa, OECD and Statistics Canada).
- OECD & Statistics Canada (2000) *Literacy in the Information Age: Final Report of the International Adult Literacy Survey* (Paris and Ottawa, OECD and Statistics Canada).
- Power, S. G. (1983) The politics of literacy, in: Bailey, R. W. & Fosheim, R. M. (Eds) *Literacy for Life: The Demand for Reading and Writing* (New York, Modern Language Association of America).
- Psacharopoulos, G. P. (1973) *Returns to Education: An International Comparison* (Amsterdam, Elsevier).
- Psacharopoulos, G. P. (1981) Returns to education: an updated international comparison, *Comparative Education*, 17, pp. 321–341.

- Psacharopoulos, G. P. (1985) Returns to education: a further international update and implications, *Journal of Human Resources*, 20, pp. 583–604.
- Psacharopoulos, G. P. (1994) Returns to investment in education: a global update, *World Development*, 22, pp. 1325–1343.
- Romer, P. (1990) Endogenous technological change, *Journal of Political Economy*, 98(5), pp. S71–S102.
- Schultz, T. W. (1961) Investment in human capital, *American Economic Review*, 51(1), pp. 1–17.
- Smith, M. C. (1996) Differences in adults' reading practices and literacy proficiencies, *Reading Research Quarterly*, 31(2), pp. 196–219.
- Solmon, I. C. & Fagnano, C. L. (1994) Benefits of education, in: Husen, T. & Postlewaite, T. N. (Eds) *The International Encyclopedia of Education, Second Edition* (Oxford, Pergamon Press), pp. 510–521.
- Solow, R. (2000) Towards a macroeconomics of the medium run, *Journal of Economic Perspectives*, 14(1), pp. 151–158.
- Spence, M. (1973) Job market signaling, *Quarterly Journal of Economics*, 87, pp. 355–374.
- Sturman, A. (1997) Socialization, in: Saha, L. J. (Ed.) *International Encyclopedia of the Sociology of Education* (Oxford, Pergamon Press), pp. 528–533.
- Sweetland, S. R. (1996) Human capital theory: foundations of a field of inquiry, *Review of Educational Research*, 66(3), pp. 341–359.
- Tough, A. (1979) *The Adult's Learning Projects: A Fresh Approach to Theory and Practice in Adult Learning* (Toronto, Ontario Institute for Studies in Education Press).
- Tuijnman, A. C. (1989) *Recurrent education, earnings, and well-being: a fifty-year longitudinal study of a cohort of Swedish men*, *Acta Universitatis No. 24* (Stockholm, Almqvist & Wiksell International).
- Tuinman, A. C. (1991) Lifelong education: A text of the accumulation hypothesis, *International Journal of Lifelong Education*, 10(4), pp. 275–285.
- Tuijnman, A. C. & Keeves, J. P. (1997) Path analysis and linear structural relations analysis, in: Keeves, J. P. (Ed.) *Educational Research Methodology and Measurement: An International Handbook, Second Edition* (Oxford, Pergamon Press and Elsevier Science), pp. 621–633.
- Tuijnman, A. C. & ten Brummelhuis, A. C. A. (1992) Determinants of computer use in lower secondary schools in Japan and the United States, *Computers in Education*, 19(3), pp. 291–300.
- Wolfe, B. L. & Zuvekas, S. (1997) Non-market outcomes of schooling, *International Journal of Educational Research*, 27, pp. 491–502.
- Woodhall, M. (1995) Human capital concepts, in: Carnoy, M. (Ed.) *International Encyclopedia of Economics of Education, Second Edition* (Cambridge, Cambridge University Press), pp. 24–33.

Appendix A: Supplementary Tables**Table A1.** Matrix of disattenuated correlation coefficients for adults aged 25–55 years in Canada, 1994 ($n = 2731$)

	η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	η_9	η_{10}	ξ_1	ξ_2	ξ_3	ξ_4
η_1	1.00													
η_2	0.21	1.00												
η_3	0.44	0.17	1.00											
η_4	0.49	0.13	0.46	1.00										
η_5	0.31	0.20	0.17	0.35	1.00									
η_6	0.45	-0.08	0.27	0.49	0.23	1.00								
η_7	0.03	-0.10	0.01	0.04	0.00	0.14	1.00							
η_8	0.69	0.21	0.31	0.41	0.28	0.37	0.02	1.00						
η_9	0.30	0.66	0.24	0.36	0.26	-0.08	-0.17	0.33	1.00					
η_{10}	0.23	0.10	0.11	0.15	0.23	0.34	0.10	0.30	0.14	1.00				
ξ_1	0.02	0.30	0.07	0.03	0.11	-0.25	-0.16	0.02	0.36	-0.01	1.00			
ξ_2	-0.08	-0.01	0.06	-0.01	-0.02	0.06	0.01	-0.25	-0.12	-0.13	0.01	1.00		
ξ_3	0.60	0.05	0.25	0.24	0.17	0.36	0.03	0.48	0.11	0.17	0.03	-0.01	1.00	
ξ_4	-0.49	-0.01	-0.12	-0.21	-0.19	-0.23	-0.02	-0.35	-0.06	-0.04	-0.01	0.08	-0.36	1.00

Note:

ξ_1 , home background (HBG); ξ_2 , experience (EXP); ξ_3 , non-native language status (NNL); ξ_4 , gender (GEN); η_1 , formal learning (FL); η_2 , labour force participation (LFP); η_3 , knowledge intensity of occupation (KNO); η_4 , non-formal job-related learning (JRN); η_5 , informal job-related learning (JRI); η_6 , informal personal-interest-related learning (PRI); η_7 , personal-interest adult education (PRN); η_8 , skill (SKI); η_9 , economic outcomes (EO).

Source: Canadian Adult Literacy Survey, 1994.

Table A2. The independent (Γ) and dependent (B) standardized maximum likelihood regression weights with their standard errors and t values in a model of economic outcomes for adults aged 25–55 years in Canada, 1994

	ξ_1	ξ_2	ξ_3	ξ_4	η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2
η_1	–0.08 (0.02) –5.162	–0.05 (0.02) –3.409	0.485 (0.02) 23.824	–0.31 (0.02) –18.74									0.445
η_2	0.298 (0.02) 16.67	–0.07 (0.02) –3.793	–0.1 (0.02) –4.294	0.115 (0.02) 5.639	0.322 (0.03) 12.934								0.141
η_3	0.043 (0.02) 2.388	0.087 (0.02) 5.135	0.105 (0.02) 4.489	0.113 (0.02) 5.74	0.421 (0.03) 16.776	0.058 (0.02) 3.151							0.216
η_4	*	*	–0.07 (0.03) –2.858	0.042 (0.02) 1.988	0.425 (0.03) 15.028	–0.04 (0.02) –2.045	0.308 (0.02) 14.803						0.319
η_5	0.067 (0.02) 3.631	*	*	–0.08 (0.02) –3.745	0.135 (0.03) 5.418	0.129 (0.02) 6.822	–0.05 (0.02) –2.239	0.267 (0.02) 10.971					0.167
η_6	–0.24 (0.02) –11.97	0.084 (0.02) 4.591	0.157 (0.03) 6.245	*	0.196 (0.03) 7.068	–0.11 (0.02) –5.618	*	0.344 (0.03) 13.055	0.07 (0.02) 3.488				0.419
η_7	–0.11 (0.02) –5.529	*	*	*	*	–0.06 (0.02) –3.142	*	*	*	0.104 (0.02) 4.669			0.039
η_8	*	–0.21 (0.01) –14.98	0.124 (0.02) 6.469	*	0.499 (0.02) 21.239	0.083 (0.02) 5.628	*	0.073 (0.02) 3.611	0.045 (0.02) 2.973	0.07 (0.02) 3.289	*		0.543
η_9	0.13 (0.01) 9.133	–0.07 (0.01) –4.976	*	0.044 (0.02) 2.958	0.055 (0.02) 2.588	0.514 (0.01) 36.231	*	0.318 (0.02) 16.465	0.037 (0.01) 2.638	–0.22 (0.02) –10.71	–0.08 (0.01) –6.292	0.123 (0.02) 6.201	0.59

Note:

*Parameter not statistically significant, $p > 0.05$. ξ_1 , home background (HBG); ξ_2 , experience (EXP); ξ_3 , non-native language status (NNL); ξ_4 , gender (GEN); η_1 , formal learning (FL); η_2 , labour force participation (LFP); η_3 , knowledge intensity of occupation (KNO); η_4 , non-formal job-related learning (JRN); η_5 , informal job-related learning (JRI); η_6 , informal personal interest-related learning (PRI); η_7 , personal-interest adult education (PRN); η_8 , skill (SKI); η_9 , economic outcomes (EO).

Source: Canadian Adult Literacy Survey, 1994.

Table A3. The independent (Γ) and dependent (B) standardized maximum likelihood regression weights with their standard errors and t values in a model of social outcomes for adults aged 25–55 years in Canada, 1994

	ξ_1	ξ_2	ξ_3	ξ_4	η_1	η_2	η_3	η_4	η_5	η_6	η_7	η_8	R^2
η_1	–0.08 (0.02) –5.16	–0.05 (0.02) –3.44	0.485 (0.02) 23.824	–0.31 (0.02) –18.71									0.446
η_2	0.298 (0.02) 16.665	–0.07 (0.02) –3.777	–0.1 (0.02) –4.263	0.115 (0.02) 5.633	0.321 (0.03) 12.902								0.141
η_3	0.043 (0.02) 2.384	0.087 (0.02) 5.119	0.105 (0.02) 4.492	0.113 (0.02) 5.75	0.421 (0.03) 16.759	0.058 (0.02) 3.15							0.216
η_4	*	*	–0.07 (0.02) –2.797	*	0.389 (0.03) 15.029	*	0.31 (0.02) 14.952						0.311
η_5	0.068 (0.02) 3.684	*	*	–0.07 (0.02) –3.584	0.14 (0.03) 5.685	0.126 (0.02) 6.684	–0.05 (0.02) –2.235	0.266 (0.02) 11.001					0.169
η_6	–0.24 (0.02) –11.85	0.085 (0.02) 4.664	0.155 (0.03) 6.129	*	0.206 (0.03) 7.481	–0.12 (0.02) –5.876	*	0.338 (0.03) 12.926	0.071 (0.02) 3.529				0.415
η_7	–0.11 (0.02) –5.54	*	*	*	*	–0.06 (0.02) –3.139	*	*	*	0.104 (0.02) 4.674			0.039
η_8	*	–0.21 (0.01) –14.94	0.125 (0.02) 6.496	*	0.5 (0.02) 21.33	0.082 (0.02) 5.561	*	0.072 (0.02) 3.618	0.045 (0.02) 2.995	0.068 (0.02) 3.227	*		0.543
η_{10}	0.051 (0.02) 2.609	–0.12 (0.02) –6.25	*	0.109 (0.02) 5.766	*	0.069 (0.02) 3.566	*	–0.12 (0.03) –4.863	0.14 (0.02) 7.25	0.345 (0.03) 12.486	0.074 (0.02) 4.168	0.172 (0.02) 7.403	0.205

Note:

*Parameter not statistically significant, $p > 0.05$. ξ_1 , home background (HBG); ξ_2 , experience (EXP); ξ_3 , non-native language status (NNL); ξ_4 , gender (GEN); η_1 , formal learning (FL); η_2 , labour force participation (LFP); η_3 , knowledge intensity of occupation (KNO); η_4 , non-formal job-related learning (JRN); η_5 , informal job-related learning (JRI); η_6 , informal personal interest-related learning (PRI); η_7 , personal-interest adult education (PRN); η_8 , skill (SKI); η_{10} , social outcomes (SO).

Source: Canadian Adult Literacy Survey, 1994.

Table A4. The independent and dependent standardized measurement model for adults aged 25–55 years in Canada, 1994

Theoretical variable, ξ	Observed variable, X	Factor loadings, λ_x	s.e.	t Value
<i>Independent variables</i>				
ξ_1 -Home background (HBG)	X_1 -Father's educational attainment (FED)*	0.938	(0.02)	56.19
	X_2 -Mother's educational attainment (MED)	0.721	(0.02)	40.42
	X_3 -Father's two-digit occupation (FOC)	0.552	(0.02)	29.57
ξ_2 -Experience (EXP)	X_4 -Age minus years of education minus five (EX)*	1		
ξ_3 -Non-native language status (NNL)	X_5 -Non-native language status (LAN)*	1		
ξ_4 -Gender (GEN)	X_6 -Gender (MF)*	1		
Theoretical variable, η	Observed variable, Y	Factor loadings, λ_y	s.e.	t Value
Dependent variables η_1 - Formal learning (FL)	Y_1 -Highest level of education completed (LEV)*	0.998	(0.02)	66.73
	Y_2 -Years of schooling (YRS)	0.961	(0.02)	64.35
η_2 -Labour force participation (LFP)	Y_3 -Labour force participation (LP)*	1		
η_3 -Knowledge intensity of occupation (KNO)	Y_4 -Classification ^a of four-digit occupation (SOC)	1		
η_4 -Non-formal job-related learning (JRN)	Y_5 -Participation in job-related adult education and training (PJR)*	1		
η_5 -Informal job-related learning (JRI)	Y_6 -Intensity of writing letters or memos at work (W1)*	0.84	(0.02)	46.53
	Y_7 -Intensity of reading articles or reports at work (RW)	0.78	(0.02)	43.02
	Y_8 -Intensity of writing articles or reports at work (W2)	0.701	(0.02)	37.85
η_6 -Informal personal interest-related learning (PRI)	Y_9 -Frequency of visits to library (LIB)*	0.754	(0.02)	36.18
	Y_{10} -Intensity of writing letters at home (WH)	0.707	(0.02)	34.29
	Y_{11} -Intensity of reading books at home (RH)	0.704	(0.02)	34.13
η_7 -Non-formal personal interest-related learning (PRN)	Y_{12} -Participated in personal interest-related adult education and training (PPR)*	1		
η_8 -Skill (SKI)	Y_{13} -Quantitative literacy (QUA)*	0.937	(0.02)	60.92
	Y_{14} -Document literacy (DOC)	0.936	(0.02)	60.78
	Y_{15} -Prose literacy (PRO)	0.918	(0.02)	59.05

Table A4. (*Continued*)

Theoretical variable, η	Observed variable, Y	Factor loadings, λ_y	s.e.	t Value
η_9 -Economic outcomes (EO)	Y_{16} -Annual earnings from wags and salaries in 1993 (EAR)*	1		
η_{10} -Social outcomes (SO)	Y_{17} -Frequency of participating in volunteer or community organizations (COM)*	1		

Note: S.E., Standard error.

^a Occupations are classified into a knowledge intensity scale using Lavoie and Roy's (1998) scheme.

* Fixed parameter.

Source: Canadian Adult Literacy Survey, 1994.

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