

This article appeared In Wallace, T., Murphy, N., Lepine, G. and Brown, D. 2005 Exploring New Directions in Essential Skills Research. Ottawa: Public Policy Forum, pp. 22-40.

EDUCATION AND EMPLOYMENT: OVERVIEW OF RESEARCH AND POLICY ISSUES *

© **K.V.Pankhurst**
Centre for Studies in Education & Work
Ontario Institute for Studies in Education
University of Toronto

INTRODUCTION

This paper aims to identify the issues that should be considered if more effective public policies are to be formulated for education¹ and employment in relation to the economy, and to consider their application to the HRSDC Essential Skills activity.

The discussion sets the broad perspective for a critical reconsideration of thinking about education and work in research and in policies. It reviews the history of experience with theoretical and practical attempts to relate education and the economy, and the concepts of work and of education implicit in them. In order to understand better the relationship between a worker and a job the discussion examines the nature of work and the full range of human cognitive abilities formed and utilised in work. This is a condition of understanding the interrelationships between economic efficiency and productivity on one hand and inequalities in education and jobs on the other.

It is widely assumed in public policies in Canada, and many other countries too, that education is a major factor of economic performance and growth, and of individual and social well-being. There is, however, little empirical evidence for that assumption. Statistical correlation between vicarious indicators for education and output does not constitute scientific proof, merely a reason to seek an explanation. Far greater attention has been given to such issues as general labour market conditions, the organisation of training, access to paid work, and conditions surrounding employment, than to the abilities used in performing a job. When it comes to examining what is done in a job, and how, we are concerned with nothing less than human nature and behaviour. To understand the abilities used in work we have to draw on the relevant findings of several branches of the social sciences, and on the historical experience of a variety of policy and programme attempts to link education and work. The task is vast, difficult and complex. Given the broad sweep of this relatively short paper and the limited time of the Symposium, it should be read as the precursor of a more comprehensive and detailed critical examination.

Part I briefly reviews conceptual approaches to the relationships among education, the economy and productivity. Part II outlines the main conceptual issues in considering the nature of work, the attributes of workers, and the relationship between work and learning.

* I acknowledge helpful comments and suggestions from colleagues in the Centre for Studies in Education and Work and from participants in the Symposium.

¹ Education is used to include vocational education and training.

Part III briefly applies the criteria drawn from Parts I & II to the Essential Skills (ES) activity in HRSDC. Part IV suggests some central principles and directions for research and policies.

I: CONCEPTS OF THE RELATIONSHIP BETWEEN EDUCATION AND THE ECONOMY

A shifting agenda

Experience with attempts to devise methods to analyse the relationship between education and the economy, and to design public policies, has revealed many deep and difficult issues that have still to be resolved. The relationship between education and society or economic activity has been conceived in a variety of ways (Maroy & Doray 2000); but whilst the focus has changed the nature of the connection between education and what it achieves remains elusive. The great expansion of education after the end of World War II was initially justified as an instrument of democracy that could create more equal opportunities, but created the issue of how it was to be designed and organised in relation to employment. Fears that labour scarcities would inhibit growth led to employment forecasting (e.g. Economic Council of Canada 1964; Meltz & Penz 1968; Ahamad 1969), but methods made relatively simple assumptions about the coefficients between labour inputs and outputs, and no mechanism existed to allocate the supply of education by subject field to occupational requirements. In the 1950s and 60s, theories and policies for production placed heavy emphasis on fixed investment until empirical work indicated that it was an incomplete explanation of growth (Abramovitz 1956). Education was assumed to be the ‘missing factor’ (Denison 1964). Human capital theories and rate of return calculations demonstrated variations in the benefits associated with education, and appeared to offer a rationale for a more efficient distribution of education, but in programme design the human capital approach was superseded by more pragmatic approaches.

One direct method was a major attempt to specify employers’ needs for the performance of a job. The US Bureau of Employment Security devised a comprehensive and detailed approach in the conception of Worker Traits Requirements (WTR) in the 1950s (US Department of Labor 1956). It aimed to make the Dictionary of Occupational Titles more useful for placement.² At a series of experts’ conferences the aptitudes identified were *training time*, composed of General Educational Development (GED) and Specific Vocational Preparation (SVP) and *aptitudes*, which included intelligence, interests, temperaments, work performed, physical capacities and working conditions. As empirical testing of the WTR in all occupations was impossible, they were examined for a sample of 4,000 occupations. That set of attributes was used with few changes in successive editions of the DOT, and adopted in the 1971 Canadian Classification and Dictionary of Occupations (CCDO) where it was described as ‘qualifications profiles’ (Canada Department of Manpower & Immigration 1971), and in the National Occupational Classification (NOC), which uses the term ‘skill levels’ to indicate the level of

² ‘The goal has been a single classification structure that made available to employers the largest number of qualified workers, and made available to workers all possible jobs for which they were suited’ (Bureau of Employment Security 1956, p i).

educational attainment required in employment (Human Resources Development Canada 2001). Subsequently a few modifications have been made in the light of experience. GED and SVP have been combined, and seven levels merged into four. A review of methods in the DOT (Miller et al. 1980), which examined the rating procedure, identified the technical problems of observing jobs. The review found no evidence that traits were constant, which left unanswered questions about the validity of ratings. Differences among the decisions of the experts who rated jobs raised issues of the reliability of their judgments. There was evidence of gender bias in the ratings given to men and women performing the same type of work. Data about 'jobs' are about groups of similar jobs ('positions'); so do not indicate the variability among particular jobs. The term 'functional or performance requirements' was described by Fine (1968, p365) as '... the requirements determined by objective job analysis as necessary and sufficient *to achieve average performance*³ in the specific tasks of the jobs; which implicitly acknowledged variability. The Miller inquiry of 1980 found that formal attributes said to be required to perform a job could not always be distinguished from the attributes of the incumbent worker, and the latter were sometimes used as evidence, leaving open the question of whether functional requirements or the social status of a job was being observed. Whether to use data from expert observers or from the incumbent about the requirements to perform a job is a persistent methodological dilemma.

Mobility

We have inadequate evidence about mobility among occupations, jobs and tasks. The existence of job and occupational mobility can be inferred from progressive changes in the structure of the economy, and the introduction of new technologies. For example, in Canada during the two year period 1986-1987, c.6.1 million workers, or c.48% of the labour force, changed their labour force status during those two years: they either moved in or out of the labour force, or moved from being employed to being unemployed, or from being out of work to getting a job, or changed their jobs (Statistics Canada 1987). Analyses of the national Graduate Surveys about movements among occupations (Ahamad 1997; Krahn & Bowlby 1999) also illustrate the need for more detailed data of mobility, both among tasks within a job, and among jobs.

In the absence of detailed data, the assumption that mobility is the transfer of knowledge from one job to another has led to a variety of attempts to establish *a priori* the characteristics of transfer which have been unremarkable for their influence on curricula. Examples are Generic Skills in Canada (Smith 1978), common transferable skills (McKinlay 1976; Sjogren 1977; Pratzner & Stump 1978; OECD 1978), the competencies required in working life (Ministère de l'Éducation Nationale 1978; OECD 1982). In the same lineage is the description of 'essential skills' as the attributes used to perform a range of jobs. However, it is misleading to assume that mobility entails the transfer of something, whether knowledge or 'skills'. This misconception is too easily interpreted as an argument to provide exogenously specific training that will enable a person to adapt to a different set of job functions. The further implicit assumption that a worker is predominantly passive overlooks the evidence that abilities are acquired and developed

³ My italics

by experience while working. A more sound explanation of mobility is the transfer of personal cognitive abilities to resolve problems and to modify one's own cognition.

Inequalities

Another direct approach to the relationship between education and employment has been to examine specific inequalities. The focus changed to problems of access to employment for particular groups such as young people (OECD 1978; 1980), which emphasised the dilemma of a lack of experience that prevented a young person from obtaining a job that would provide experience; women (OECD 1975; 1986), which led to special efforts to redress access to education and jobs; and immigrants, which raised fears of unemployment for native born workers.

Next came critiques of schooling. The 1964 International Comparisons of Educational Achievement (IEA) study was an attempt to enrich the analysis of the relationship between education and growth. It identified differences in standard among twelve countries, but was found to contain errors in sampling schools and comparable age groups (e.g. Prais & Wagner 1983). A Nation at Risk (US Department of Education 1983) suggested that the difficulties of many people in the US in finding work could be ascribed to deficiencies in education. Recent studies of distributions of scores in general educational tests in the Programme on International Student Attainment/Assessment (PISA), and on literacy and numeracy from the International Adult Literacy Survey (IALS) confirm that large proportions of people still have less than average attainment. However, the measurement of educational attributes and standards has proved far from simple.

There is now fairly comprehensive evidence for several countries of a lack of correspondence between the education levels thought to be required to perform jobs and the levels of attainment of the labour force. A large and increasing proportion of the labour force with relatively high levels of attainment is in jobs for which a lower level is required, whilst a large segment of the labour force has lower levels of attainment than are required (Berg 2002; Hartog 2000). The same phenomenon is found in Canada (Livingstone 2004; Krahn & Lowe 1998; Vahey 2000). This phenomenon, which has been interpreted as *overeducation* or *underutilisation* of those with higher levels of education, combined with *undereducation* and scarcities of people in supposedly lower level occupations, has resulted in 'bumping', a chain of relative downward displacement in jobs (Borghans and de Grip 2000). These analyses provide fairly convincing reasons for thinking that the abilities of a large proportion of the labour force with relatively high levels of formal education could be better utilised. The interpretation of the data about workers with low levels of formal education is more problematic, since they are employed in jobs that ostensibly require a higher level of education; but it would be absurd to conclude that they are 'overutilised' or unable to perform their jobs. A more plausible interpretation is that their levels of formal educational attainment describe neither the kinds of work done by people in this segment of the labour force, nor the abilities they use in performing their jobs. The evidence about the content of the work done by these workers and the abilities that enable them to do their jobs is insufficient.

Whilst it is evident that education levels are inadequate indicators of knowledge and abilities, testing also has key weaknesses. Tests establish rank orderings rather than absolute levels. Moreover, tests reveal only what is tested, and a vast amount of personal knowledge among adult members of the labour force is unobservable. The term *tacit knowledge* (Polanyi 1966) to describe personal knowledge is not entirely satisfactory, because what is unobservable is potential ability that sometimes does not come into existence until a worker is faced with an unexpected problem.

Attempts have been made in recent years to describe directly individual abilities acquired by experience, especially among those with low levels of education who have demonstrated competence in their work, but lack a credential. The approach of *criterion referencing*, which aims to observe directly what a person can do, rather than compare what he or she knows with what others know (*norm referencing*), has been used primarily in educational testing, and in some innovations to describe the efforts made by students who do not perform well in school by traditional norms. It is used much less in employment. It is not viewed favourably by those whose pay and position depend on a credential. A more pragmatic attempt to observe what a worker knows is the movement in Canada and other countries for Prior Learning Assessment and Recognition (PLAR) which uses the technique of having a person describe in a portfolio what he or she has learned by experience and can do⁴. The potential of PLAR has been undermined by organised programmes to teach portfolio writing, and the creation of a new occupation to teach how to write them, which destroy the observation of initiative in personal learning. The practice has been mainly used in selection for admission to further education courses rather than to establish demonstrated competence for purposes of pay and promotion. The issue of how to recognise and accredit competence acquired by experience, particularly among the labour force in low level and low paid jobs, has yet to be addressed and incorporated effectively into policy.

Education & productivity

There is an implicit assumption predominant in theories and public programmes that the traditional temporal order, in which education is separate from and precedes employment, is logical and necessary. The demand for labour is presumed to derive from demands for final output, and the demand for education to derive from the demand for labour. Education and employment are still predominantly separated institutionally in government administration, and between school, colleges and universities on one hand and employing firms and institutions on the other. Whilst some programmes for recurrent education and lifelong education have changed the temporal order in the interest of greater equity, the implicit concept is still that productive activity is governed by education, education is exogenous to employment and the economy, and education is a condition of production.

When education, or some variant of it, is treated as an input into production, and growth, employment, occupation, earnings or productivity as the output, the implicit assumption of a causal connection in one direction shows relatively little regard for the relationship in the other direction. Although education has often been assumed to explain economic growth, spending on education increased during the 1950s and 60s as a proportion of

⁴ www.oise.utoronto.ca/depts/sese/csew/nall

rising national incomes, suggesting that education was the result rather than the cause of economic growth (Schultz 1960). Rate of return estimates of human capital (e.g. Becker 1964; Weale 1993; Sweetman 2002) take a further step in assuming that human capital can be measured,⁵ and that wages are reliable measures of labour productivity⁶. The technical problem is that high levels of theoretical abstraction and statistical aggregation obscure the intrinsic nature and details of the relationship between education and society. The logical problem is that a purely economic rationale neglects social selection in access to education, which cumulates throughout the stages of formal schooling to create a population with highly unequal levels of formal education. We have as yet no firm empirical data about the dispersion of abilities at birth that will allow us to conclude how great is the disparity between them and the dispersion of levels of education subsequently attained. Correspondingly, the design of work organisations embodies the predominant assumption that higher level jobs require workers with more education than jobs at lower levels. For example, the International Standard Occupational Classification lists types of work in what is described as a ‘natural order’, descending from managerial and administrative to unskilled occupations. Since wages reflect relative social valuations, measuring the productivity of workers by wages is circular reasoning. Calculations using wages cannot take account of what happens in a job.

It might be expected that the acceptance in economic theory of the concept of learning endogenous in activity (Arrow 1962; Rosen 1972; Romer 1986; Solow 1997) would help alter policy thinking and managerial practice; but the idea has yet to be well established empirically or explained theoretically. A large and growing volume of empirical estimates of cost/output functions, popularly known as experience functions, for many industries and countries, demonstrates a continuous growth of productivity in the form of progressively reduced costs of labour per unit of output at fairly steady rates (e.g. Adler & Clark 1991; Gruber 1992; Bahk & Gort 1993; Cabral & Riordan 1994). Whilst these calculations provide *a priori* reasons for thinking that endogenous learning is present during production, and that that form of learning is more significant for productivity than formal education, they remain silent about the nature of learning, how it arises during work, and how it affects a worker’s performance.

In job and occupational data systems and in public employment policies, theories of work and education are absent. The relationship between a worker and the work that he or she does is occluded by measuring education as the output from the formal education system, and by conceiving work as a specified and static set of tasks. Education attainment data typically refer to the numbers of people who have left various levels of formal schooling, not to what they understand. This also implies that education is something exogenous to a job or to a worker, and ignores the endogeneity of self-directed individual learning by experience. Although workers are no longer assumed in economic theory, as they once were, to be homogeneous, they are still too frequently treated as passive instruments of production. The grouping of education levels into fewer larger categories might imply some relaxation of a tight, direct connection between education levels and jobs. But at the same time, credentials are now being more precisely specified, implying a belief in them as technically essential for performance. Attempts to devise concepts and measures of a

⁵ By such measures as duration of schooling plus the cost of earnings foregone while in school.

⁶ A key theoretical assumption of neoclassical economic theory, which few economists now accept.

direct relationship between education and the performance of types of job reveals no clear vision of the functional connection between them other than as a sorting exercise. But both learning and work are processes too complex to be described by a single indicator. The conclusion is that both education and work have to be reconceived if the relationship between them is to be adequately understood.

II: WORK AND LEARNING

The nature of a job

Although in practice attempts are often made to describe jobs for purposes of hiring, pay or appraisal, the concept of a job is less precise than is often supposed. Two significant developments in research discuss work as more than an exchange of effort for wages. One is that it would be impossible for every stage of production to be governed by contracts organised by market competition (Coase 1937; Doeringer & Piore 1971; Williamson 1985), so production is governed instead by a system of administrative decisions made within a hegemonic power structure. The second is that, unlike other contracts, the contract of employment is not a contract for specific performance. A worker undertakes to provide the ability to work, not a specific output (Marx 1865; Garnier 1984). As the content of work cannot be fully prescribed, there is in every job, including low paid work, a margin of discretion (Jaques 1956; Fox 1974; Simon 1951).

Observing the content of individual jobs is occluded by the changing pattern of jobs in the economy. The division of labour is continuously reorganised under the influence of technological innovation and shifts in the composition of final demand. Lindbeck & Snower (1996) observe a trend towards a flattening of organisational structures within enterprises. Labour mobility is another phenomenon of overall productivity growth. The labour force is continuously reallocated among industries and occupations from those where productivity is relatively low to those where it is higher, but more data is available about geographical movements of labour than about functional mobility among jobs and types of work⁷. The high rate of turnover in the labour market, the incidence of which is unevenly distributed (Statistics Canada 1987), entails frequent changes of job; but we lack good information about the changes of work that are entailed.

A long term trend can be observed for labour productivity to continue increasing. In durable goods manufacture in Canada, for example, crude labour productivity has risen during the past 40 years at an average annual rate of c.3%. Labour productivity either increases production per worker employed, reduces inputs of labour for a given output, or some combination of the two. In one way or another, more work is done per worker. The conclusion is that neither the numbers of people employed nor the content of work is constant, but that both change dynamically as the experience of producing is acquired. This phenomenon can be related to observations of changes in levels of labour utilisation. The thesis proposed by Braverman (1974) of progressive 'deskilling' has not been substantiated empirically, primarily for lack of good data about the use of abilities. To the

⁷ The 1967 Survey of Highly Qualified Manpower in Canada, of the former Federal Department of Manpower and Immigration, provided broad data about the extent of movements between field of education and employment. More refined data are needed to establish the extent to which mobility entails a change of work functions.

extent that changes in the abilities used can be measured by changes in occupational attributes⁸ recorded in the Dictionary of Occupational Titles in the US, the picture is one of ‘upskilling’ in some occupations, combined with ‘downskilling’ in others, and no certainty that one is greater than the other (Spenner 1983).

In occupational analyses a job is usually defined as a group of positions, and data about each are merged to give a stylised description of a standardised mix of functions. That procedure of consolidating data, which is appropriate for career counselling and initial occupational choice, occludes variability and leaves us ill-informed about the extent to which jobs differ. The attributes recorded, however, give a partial view only of the complexity of a typical job. They exclude the personal qualities that individual workers need to deal with aberrant situations, such as abuses of power, and racial, religious, age or gender discrimination. The empirical evidence of the extent of some these departures from a norm is illustrated by a review of judicial cases (Council on Race Relations in Canada c2000)

The nature of a worker

A contract of employment is made between an employer and a worker as a person. Marx recognised that labour power was owned and exercised by a worker. Although an employer allocates work, the incumbent worker still has decisions to make about the pace of work, the degree of care in performing it, and how to deal with uncertainties created by unanticipated contingencies. All workers are engaged in a psychological activity (Jevons 1870; Jaques 1956) of problem solving, decision making and implementation. A worker is necessarily a learner who does more than adapt knowledge. The task is to better understand learning during work, and the nature of human thinking which uses three distinct but interconnected mental processes.

Sensorimotor learning connects physical responses to the five senses of sight, hearing, touch, taste and smell. The key element is individual perception and internal response. (Lamarck 1809; Darwin 1859). The human brain has evolved in size and shape, particularly the cerebellum, and has become capable of mental processes by which human beings adapt themselves to the external environment and use their abilities to modify it (Lorenz 1970). Research progress in the neurosciences is demonstrating that the senses combine, interpolate and extrapolate very large quantities of external data at extremely high speeds to create coherent perception and coordinated action (e.g. Shiffrar et. al. 1995).

The second mental process can be described as intuition, by which mental activities and behaviour are linked to the external physical and social environment. Behaviouralist theories of psychology since Pawlow (1906) posit automatic responses to stimuli. Cognitive theories, beginning with the *gestalt* (Wertheimer 1912; Koffka 1922) explain individual responses to newly perceived data in relation to a prior conceptual or theoretical framework of understanding. Data are either assimilated to confirm an existing framework of reference, or that framework is modified. The process is very fast, and not necessarily explicit. Those who are not formally numerate can have a sufficient

⁸Although Spenner concluded that occupational data from the DOT is the best that is available, the categories are too heterogeneous to support fine analysis.

sense of quantitative relationships to be able to function, and those who are not formally literate can be sufficiently articulate to be able to communicate and perform their jobs. The main conclusions are that this aspect of learning is a continuous process that reorganises data and reformulates coherent understanding, it happens rapidly enough for immediate action, and a worker is not always fully aware of it. This kind of mental process has low status because it is rarely recognised to be common among all human beings at all levels of education and work. Yet it is a central quality of the ability of everyone to think and act in a timely way.

The third feature is formal propositional (or reflective or explicit) knowledge. Understanding that is codified in pictograms, written language, and numerical and algebraic notation, permits a *corpus* of knowledge to be stored and communicated by explicit reasoning. Formal higher education places heavy emphasis on this form of understanding, and employers reward it. Explicit reasoning also makes it possible for us intentionally to observe, discuss and modify our own cognitive processes. But codification has limits. Formalising thought in explicit language is relatively slow, and it can be difficult to put intuition into words. Individual differences in the perception of linguistic codes create semantic issues. Research employs propositional, explicit thinking at its most rigorous, and requires scrupulous respect for the design of experiments and rules of evidence (Popper 1959); but thinking by most people is heuristic, less than rigorous, and can be biased (Kahneman & Tversky 2000).

The milieu of learning at work is quite different from formal schooling. Learning in formal education is predominantly familiarisation and instruction about a curriculum devised by instructors, which offers relatively limited opportunities to learn entirely on one's own (Thomas 2000). In contrast, adults learn indirectly by the experience of dealing with a great variety of problems in life and work, which are often ill defined (Sternberg 2000), and might not be defined at all, so are not perceived as problems. A key instructional technique is teaching algorithms, routines for dealing with formally specified problems that are capable of being solved. Individual workers devise their own methods (Tough 1971) and mental procedures (Scribner 1986) to deal with their tasks. A problem might have no determinate solution but a range of options, and might even be insoluble. Many practical problems have to be resolved in a pragmatic learning process by groups of people whose expertise and opinions differ.

The hierarchical structure of levels of education and jobs is inconsistent with the use at all levels of education and work of the three mental processes outlined above. Empirical evidence of the extent of learning by adults is illustrated by OISE surveys of learning 1986 to 2004. The incidence of informal learning is relatively high at about 15 hours a week, which is c. 37.5% of a standard work week, and relatively similar in amount among workers at all levels of formal education and employment. Respondents report that what they learn in unpaid work activities has applications in paid work.

The theoretical explanation of the motivations to act and learn is that, as the instincts for food and shelter are satisfied, we form new desires to improve the cultural environment (Lorenz 1970). As we do so, the perception of incongruence between what we already know and perceive afresh arouses curiosity and the motivation to learn (Bruner 1966). Detailed empirical evidence of learning during work is still scant, but from a small and growing *corpus* of individual or ethnographic case studies some key findings emerge.

The labour process is a sequence of problem solving, decision taking and action during which a worker learns (Raveyre 1983) and the job being performed is modified (Schrank 1978). The formation of a theory or framework of reference can be explicit (Langton 1966) or be unobserved (Rose 2001). A worker devises his or her own procedures (Scribner 1986; Lave 1988; Sternberg et al. 2000). Our ability to understand our own cognitive process enables us to use selectively, control and combine intuitive and explicit thinking to develop ability, competence and expertise. Increases in competence are revealed by reductions in time taken to resolve problems and in better solutions (Glaser 1985). Intuition enables a worker to deal with complexity, and to take action in the time permitted (Hamper 1991; Rose 2001). So-called unskilled or low skilled workers are more knowledgeable about the *minutiae* of the production process and make more critically important decisions than managers might realise (Kusterer 1978; Le Bas 1983; Juravitch 1986; Hamper 1991)

The relationship between a job and a worker

The sequence of problem solving, decision making and implementation constitutes the labour process that unites a job and a worker. The essential nature of a job is action and a worker has to be able to act. The individual, personal, nature of the worker-job relationship is the key unit of observation in understanding what is done and how during a job. Since problems vary among jobs and abilities are individual, the relationship between each worker and the job he or she performs is unique. Moreover the relationship evolves dynamically. The problems to be resolved are modified by continuous changes in external conditions. Each worker learns to resolve them and in so doing forms a personal set of abilities that develops during action, but is only partly observable.

We are able to control this reserve of abilities, to greater or lesser degree, according to how and what we learn, and what we do. We can make explicit thought more intuitive by deliberately forming habits of reflective thinking, whilst at the same time retaining the power for original explicit thought. Similarly, intuitive thinking habits and psychomotor abilities can be changed by deliberate decision, and developed by practice. The ability to control one's cognitive abilities and to move selectively among different modes of thinking is a key to understanding competence. In the performance of work, physical action, intuition, and deliberate explicit logic are selectively and flexibly combined in work into smooth and apparently effortless performance. We recognise the result at its best as competence, expertise or virtuosity. Clumsiness and incompetence are states prior to the acquisition of greater competence, which is manifest in a diminishing need to modify thought and action, and is quite distinct from factual knowledge.

The neglected issue in conceiving relevant education and employment policies is how to identify and utilise better the full extent of these human abilities at all levels of measured educational attainment and of employment, which consist of reserves of knowledge and understanding that are continuously being reformulated during the experience of work.

Concepts of skill

Serious discussions of work require precise and agreed definitions, but in general usage 'skill' is vague and undefined (Vallas 1990; Spenner 1990). The word skill, which derives from Old Norse word 'skil' meaning discernment, has several derivatives that are mutually incompatible. In the plural it can indicate particular attributes of the mind, such

as dexterity, and the ability to perform them at a certain level. Whilst in the singular it is frequently used to refer to levels of formal educational attainment, the adjective ‘skilled’ has traditionally been used to distinguish the licensed trades from more abstract, and supposedly superior, academic abilities.

There is a significant difference between particular attributes or components, which can be identified, and the nature of overall human ability or competence, which rests on a human ability to perceive coherence and to coordinate faculties. But it is hard to observe this general quality. Polanyi (1958, p 62) provided an account of the nature and acquisition of practical abilities that should not be forgotten: ‘the unspecifiability of the process by which we ... feel our way forward accounts for the possession by humanity of an immense mental domain, not only of knowledge but of manners, of laws and of the many different arts which man [sic] knows how to use ... without specifically knowing their contents’. Since a person has the ability to perceive data in a conceptual framework of reference, and to combine particular mental attributes into the effective performance of a task, it is an error to try to disaggregate component abilities. ‘The disorganising effect caused by switching our attention to the parts of a whole’ arises because ‘... we originally gained control over the parts in question in terms of their contribution to a reasonable result, they have never been known, and were still less willed in themselves, and therefore to transpose a significant whole into the terms of its constituent elements is to transpose it into terms deprived of any purpose or meaning’.

A more objective and neutral term than ‘skill’ for what people know and can do is ability, which is the power to do something that rests on knowledge or understanding. Practical ability depends on effectively combining subject matter knowledge and complementary abilities into effective performance. The central issue is to understand how a set of particular attributes is mobilised by a worker and developed into progressively more competent performance.

III: A CRITIQUE OF THE ESSENTIAL SKILLS ACTIVITY

Background

The ES activity is one approach among many that have attempted to link jobs and workers’ abilities. It has a mixed parentage: occupational descriptions from the CCDO and NOC; attempts to specify worker traits required; inherited prior approaches to planning training by a deficiency model; the derived demand for labour; the International Adult Literacy Survey (IALS); studies of common or generic abilities; assumptions about mobility as a transfer of knowledge; attempts to devise policies for lifelong learning. The result is a confusion of purposes and projects in the form of descriptions of ‘skills’ thought to be essential, research on literacy, and encouragements to employers and sector councils.

Some of the failure of past attempts to relating training to employment can be ascribed to a lack of understanding of the nature of both learning and work. Work is done in a relationship between a job and a worker. The concept of ‘essential skills’ deals with one half, the demand for labour. The theory, which is unspecified, is implicitly a deficit model, which assumes that deficiencies have to be met by outside intervention to change

and manage human abilities. The logic of meeting requirements by adjusting people's attributes is a misleadingly simple, stereotypical sequence based on the supposition that requirements are known and can be adequately specified. The complement to demand is the supply of abilities and intrinsic motivations, which is rich and extensive. That applies to all workers in the labour force, including those with low levels of education who perceive, interpret and create their own jobs by thinking about them to a greater extent than they or their managers are aware. It might appear to cost less to observe deficiencies than to assess abilities, but that common assumption is questionable.

The ES activity

Although the HRSDC activity does not clearly explain the concept of 'essential skills', it is implicitly an attempt to approach those abilities used in work other than specific subject matter knowledge. But experience has revealed that defining or even describing these complementary abilities is problematic. The adjectives qualifying 'skills' have ranged from such general terms as 'basic', 'behavioural', 'employability' or 'workplace', to more specific ones such as 'literacy' and 'numeracy'.⁹ Durkheim (1911) mentioned the qualities of 'courage' and 'a taste for observation'. From time to time, the abilities required by employers have included such personal qualities as assiduity, punctuality, loyalty, and responsibility. The ES activity contains three distinct approaches to complementary abilities.

The history of training for the workplace during recent decades is of a shift from the interventionist approach in occupational training in the legislation of the 1960s, when the Government of Canada bought training places from the Provinces. That experience revealed unanticipated difficulties in devising an appropriate analytical foundation for programmes at the national level. The present pragmatic approach, which places the responsibility on employers and the Sector Councils for providing training, also shifts to them the task of identifying what training is to be given and planning it in relation to industrial and regional conditions. The few reports presented at the Symposium about how programmes are conceived and designed by regional authorities and educational institutions are valuable empirical observations, unconstrained by *a priori* reasoning. The findings reveal data about local conditions, attitudes and expectations which might not be identified in a traditional research approach founded on hypotheses formulated *in abstracto*, and so can help orient research to unknown practical problems. They show varying degrees of sensitivity to the task of helping people acquire the abilities they use in work.

The case studies presented at the Symposium of how adults learn are scientific projects, which are invaluable for introducing scientific rigor into the ES activity. They provide insights into the nature of learning among adults, and some reveal indirectly the transfer of cognitive processes among ostensibly different kinds of task or subject matter. The emphasis on the cognitive processes during learning projects would be greatly reinforced

⁹ The term 'non-cognitive skills' that is sometimes found is inherently contradictory, since abilities are necessarily cognitive.

by more in-depth examination in case studies of the cognitive processes formed and used in the performance of work.

The list of ‘essential skills’

Comparing the HRSDC list of ‘essential skills’¹⁰ with the principles of work and learning in Part II reveals several conceptual weaknesses. One major omission is subject matter knowledge. The analytical structure of the list of complementary abilities is poor in theories of work and learning, and describes neither jobs nor persons, so has little or no analytical power. The list is also incomplete: personality attributes receive no mention, but although they are difficult to observe, there is no justification for omitting them. The list of ‘skills’ lacks a logical structure, and appears to exclude intuitive thinking. The arrays of levels within each type of attribute are ordinal, not cardinal; and those rankings reflect social valuations of abstract thinking as higher than practical and manual work. It also must be remembered that employers’ requirements vary with the employment situation. A deeper issue is that the exercise proposes, *a priori*, a list of particular attributes that are components of something larger which remains to be identified. The existence of multiple interconnections among personal attributes has been demonstrated by Kohn & Schooler (1983). Even if a mere listing of attributes were complete it could give no insight into how they are used selectively and interconnected in performing a task. The variety of attributes described is a less significant aspect of complexity in work than the ability to deal with unexpected changes in circumstances, perform more than one type of mental process or action simultaneously, and establish coherent understanding and action.

One justification for including the attribute of literacy in relation to work is that it is used to a varying extent among jobs, so that anyone who is illiterate or whose levels of literacy is low is at a disadvantage in negotiating with management and in performing work. But literacy as described is propositional knowledge. Its dissection into the abilities to perform specified tasks of reading, writing or calculating reduces to banality our understanding of how adults think, learn and use what they know. Literacy is more than a facility with the forms of codification of speech. It is a means by which ideas, values and intentions are communicated, acquired and interpreted through the medium of language, which is rich in synonyms and idioms, similes, metaphors, allegories and allusions. Attempts to dissect language into components and levels fail to reveal the human ability to adapt and use language purposively. This is another example of the human ability to combine several attributes into effective performance.

Similarly, the inclusion of a dissected description of numeracy, gives no useful insights into how it is formed, adapted and used during work. Rather than use algorithms learned under instruction, adults devise their own mental and manual procedures, and modify and improve them. The cognitive ability to control one’s own cognition and to adapt a form of thinking is an important factor in the practical performance of a job and the development of personal competence.

The more important question to address is, in those jobs in which literacy and numeracy are observed to be relatively little used, as Krahn & Lowe (1998) demonstrate, what other

¹⁰ Human Resources & Skills Development Canada, n.d.

qualities enable workers to perform their jobs? The generic human ability is a capacity for problem solving, decision making and implementation. It differs from the item 'problem solving' in the ES list, which is treated as one type of 'thinking skill' that leads to a specific solution. That is an inaccurate representation of the nature of the problems that arise in work, which cannot always be identified or defined. More important, it fails to recognise that the problem solving process is a significant cognitive ability that enables the discretionary element in a job to be performed. It is an attribute that mobilises all other attributes, does not always require explicit thought, and is the vehicle for the continuous formation of abilities. The associated description of error in ES is also a misconception of the permanently incomplete nature of human knowledge, which drives curiosity and learning. A focus on the problem solving process also makes possible a common analysis of all jobs, including those considered to be low skilled or unskilled. It also reveals how misleading is the concept of an unskilled worker.

The description of 'essential skills' as attributes used among ranges of jobs repeats the errors of earlier approaches known as generic, common transferable skills or competencies used in work. Essential is an adjective to be used with care. What makes an ability 'essential'? The practical definition of essential adopted is of an attribute commonly required or used in work, rather than a *sine qua non* of being able to perform a particular job. The recurrent fashion of distinguishing cognitive and non-cognitive (including generic) skills is a false dichotomy that does not survive because the former include the latter, and cannot be confined to subject matter knowledge. The concept of ES as transferable attributes should be restated. The ability to be mobile is formed by the experience of problem solving; and because the perceptions of problems and the action taken is individual, mobility is a personal quality, not an attribute of a job.

IV: RESEARCH AND POLICY ISSUES

The issues for research and policy flow from the preceding discussion. Research and policy formulation have different purposes and time frames, but a *sine qua non* of both of them is making assumptions explicit, clarifying concepts and definitions, and reasoning with care and precision.

The research element in the ES activity.

More empirical research is needed into the attributes used in work. Although Adam Smith (1776) observed the learning that happened during the performance of many occupations, remarkably little research has been done into how a worker learns during work, and what is learned. To be defensible, policy has to be theoretically sound and use reliable data. A key methodological issue is the need for systematic empirical observation of the attributes that workers possess. Concepts devised *a priori* restrict the data that is gathered and their interpretation. Evidence about the elements on the ES list is in the form of cross-sectional data, which are static and cannot reveal the dynamic mental process of learning while working. Insufficient information about the method of obtaining data leaves uncertain whether they are observations of a particular job, a group of similar jobs, or of a worker. If the data are a cross section of jobs, the variability among jobs and incumbents is concealed. A technical review of data concepts,

definitions, sources and methods is essential¹¹, and if it is to be credible, it is imperative that it should be undertaken independently.

Empirical research also requires a theoretical framework appropriate for observing mental processes. The exercise of gathering data for analysis about groups of jobs has the potential to be converted into a vehicle for empirical case studies of how work develops within an individual job/worker relationship, and how a worker learns to deal with unexpected events and problems. That could help close a major *lacuna* in knowledge left by reliance on aggregative data and abstract concepts. A few high quality, detailed studies can provide a greater depth of understanding than comprehensive data.

The ES activity could be the vehicle for more rigorous research into the formation of technical subject matter knowledge as well as complementary abilities. That requires an analysis of technology and changes in it. An example is the restructuring of technical training in Germany in 1987, which was based on an empirical analysis of the content of jobs in the electro-mechanical industries, and further revised in 2000 to incorporate electronic engineering. The example illustrates the need for continuous surveillance of the technical content of jobs which, in turn, implies a need for research to observe how the complementary abilities required to develop and use that technical material also change.

Understanding the job/worker relationship

A focus on short term economic concerns diverts research and policies from the active and constructive role of a worker in performing a job (Simpson 1989). A first priority for research is a better understanding of the manifold issues in the job/worker relationship. To that end a broad perspective is needed to synthesise and interpret the extensive *corpus* of knowledge that we already possess in the form of scattered theoretical generalisations and empirical findings about work and learning from several disciplines, including anthropology, economics, neurological science, philosophy, psychology and sociology, which all have something different to contribute. This is a task for experienced researchers. The second priority should be better empirical data about workers' abilities as a condition of understanding of how they are acquired and used in the performance of a job.

The ES activity has a potential to be used for detailed empirical research about these two concerns. It could become an opportunity to investigate how competence and productivity develop dynamically, which cross sectional data cannot reveal. Instead of placing the emphasis on providing limited training to meet particular observed deficiencies, emphasis could with advantage be put on endogenous learning by workers, on their intrinsic motivations, and on their underlying ability to develop their own cognition. The key unit of observation is the worker/job relationship. Data about levels of educational attainment are inadequate indicators of the nature and content of the abilities that constitute human capital. Data from ranges of jobs are too broad to indicate the variance in individual abilities, or to provide valid information about the nature and incidence of mobility.

¹¹ A good example is the inquiry for the Assembly of Behavioural and Social Sciences (Miller et al. 1980).

A perception of the attributes used in work as subject matter knowledge combined with the attributes thought to be measurable, as in Worker Traits Requirements analysis, leaves many other human qualities unspecified. Major omissions are moral values and emotions, which cannot be assumed to be unimportant, but which are not well understood, and personality which is hard to come to grips with analytically. A learning theory is needed that can accommodate the diversity of behaviours observed in practice, which range from being dysfunctional in many ways, such as harassment, discrimination, competitive, prejudiced, erroneous and criminal, to demonstrations of cooperation and the pursuit of enlightened self-interest. We cannot pretend to understand performance in the workplace unless the full range of human behaviours is taken into account.

Economic policy

The present political commitment of the Government of Canada to training 'skills' assumes a connection between education and productivity that has not been clearly established theoretically or empirically with macroeconomic methods and aggregative data. In the context of international competition, especially from low wage countries, emphasis has been put on reducing costs and increasing labour productivity by spending on formal education rather than by making better use of human abilities. The rhetoric is based on poor theories of work and of education that pay too little attention to how each is distributed socially. The labour force is more capable of organised and constructive thinking, and each worker possesses a greater reserve of abilities than is recognised. The less well qualified workers have types of ability acquired from experience that are not recognised in formal tests to rank people ordinally.

The contribution of labour to productivity is more plausibly explained by the competence, expertise and professionalism formed during experience in a job, than by wages, because it directly affects improvements in the cost/output ratio. This applies to all levels of jobs, and is not indicated by education levels or job status. The conditions of developing those intrinsic qualities are threefold. [1] Continuity of employment is essential to permit sustained learning by experience, and to retain for the benefit of production and of the work force what those workers learn by experience. [2] A better utilisation of workers' abilities entails managerial practices that recognise workers' intrinsic motivations and give credit for their achievements. [3] A recognition that mobility is primarily a transfer of decision making abilities, although it might also entail using some specific subject matter knowledge common to more than one job or occupation.

Social inequalities

Deeply rooted social inequalities within both education and employment are compounded by the asymmetry in policies. People assumed to have less than average abilities receive shorter, more functionally oriented training, whilst those thought to possess greater than average abilities receive higher education that is of longer duration and subsidised. Since the relatively higher investment in education in workers with the higher levels of wages is predicated on the assumption that wages measure productivity, which many economists now recognise to be false, policies should aim to better assess the contributions of so-called 'unskilled' workers and to redress the balance for low wage workers.

Opportunities to learn and work could be better distributed in relation to abilities. In 1980 the OECD Member countries called for greater convergence between general and vocational education (OECD 1980) in order to reduce inequalities, but with the continued expansion of tertiary education social opportunities continue to diverge. Although the fusion of GED and SVP categories creates a limited parity of esteem between functional and general types of education within each of the four NOC levels, the continued stratification among levels does not come to grips with inequalities of esteem and life chances.

It is, however, possible to reduce these inequalities in a variety of ways. That requires longer and better quality training for those who do not appear to perform well in formal education, combined with better utilisation in employment. Education and work can be restructured with the central objective of developing and making better utilisation of latent and unrecognised human abilities. Whilst the interests of management and line workers differ, their roles in production overlap. The functions of decision making and learning are shared. The tasks of management entail an indirect training role through supervision and mentoring. It is a role that could be better developed. Conversely, all workers are to greater or lesser degree engaged in the overall task of management through the exercise of discretion, but whilst decision making is apparent as a formal part of managers' responsibilities, it is less evident and even completely hidden in perceptions of how line workers perform their work. The aim of better utilisation to obtain long run benefits is lost from view if the perspective is to minimise short term costs.

Placing the emphasis on adapting workers to tasks overlooks their actual and latent abilities. Prior Learning Assessment and Recognition (PLAR) is potentially more promising than the Essential Skills approach, because in principle it captures the abilities a worker has acquired by experience and his or her awareness of them.

The governance and management of education and training.

A broad review is needed of the present governance system for education and training at all levels, where there is a multiplicity of interests, responsibilities and inconsistent purposes. In the absence of a distinct constitutional allocation of the responsibility for education to one order of government in Canada¹², there is an unclear distribution of education and training programmes among them. The decentralisation of responsibilities, which gives scope for local initiative, creates a need to share experience and information about the kinds of curricula and measures that work best in practice. At the same time, the division of education and training programmes between governments and employers is unbalanced: employers bear the direct costs of specific training for their employees, whereas the state subsidises the general education of the higher qualified.

The predominant implicit assumption in policies is still that education and training confer the abilities used in work, and that they can be provided only through exogenous programmes of instruction. It is reflected in the persistent rhetoric that productivity growth requires 'investment' in education and training. It is a perspective that fails to take into account the large volume of evidence of cost/output functions about endogenously generated increases in productivity, which do not incur the costs of

¹² Unlike Federal systems in other countries that specify the obligations of one order of government and leave the residual to the other.

absence from production, or to credit the extent to which individuals learn by experience on their own.

Since human abilities are extensive, and include hidden and latent abilities to learn continuously by experience during work, an alternative to exogenous training is a better utilisation of workers' abilities to deal with problems and assistance to help develop that quality. To that end, better information is needed about the supply of abilities in the labour force, including workers' abilities to learn; but it does not follow that those abilities can be inventoried. Some of the onus is on workers to identify the abilities they have demonstrated by achievement. Prior Learning Assessment and Recognition (PLAR) can provide valuable information about what workers have learned to do, and has yet to be used for better recognition in employment. Some of the onus rests on employers to recognise those abilities in pay and promotion. Management has to be able to recognise variability in workers' abilities and modes of thinking and communication, and to deal with their degrees of ability. In that perspective, the role of supervision is one of mentoring by providing advice and continuous opportunities to learn. But it must be recognised that good utilisation is elusive. We still do not know what kinds of workplace practices work best (Gunderson 2002).

In the provision of education and training programmes, and attempting an appropriate replacement for traditional indentured apprenticeship, many interrelated issues of organisation and curriculum design have yet to be resolved. If an employer bears training costs and is exposed to uncertainties about retaining trained workers in a turbulent labour market, time for off the job training is inevitably limited, and educational institutions are expected to provide training. That raises the issues of the funding for these institutions, and the design of curricula becomes a central concern. Some instruction in existing knowledge is justified in order to help save time in acquiring it, but has to be balanced with the aim of endowing a person with the complementary ability continuously to enrich problem solving abilities. In curriculum design there is a conflict between the aims of meeting national standards for an occupation, or specific local needs. Whilst a curriculum has to balance instruction in specific subject matter and opportunities to form the complementary abilities of applying them, the dilemma remains of whether the latter should be limited to their functional use in work, or be provided for their intrinsic interest and general educational value.

SELECTED REFERENCES¹³

- Abramovitz, M. *Resource and Output Trends in the U.S. since 1870*. New York, N. Y. NBER, 1956.
- Adler, P. S. and Clark, K. B. "Behind the Learning Curve: A Sketch of the Learning Process". *Management Science*, vol 37, no. 3 (1991), pp. 267-281.
- Ahamad, B. *A Projection of Manpower Requirements by Occupation in 1975*. Department of Manpower and Immigration, Canada. Ottawa. 1969.
- Ahamad, B. *A Report on a Study of the Relationship Between Field and Occupation Using National Graduate Survey Data*. Unpublished typescript. HRDC. Ottawa. 1997.
- Arrow K. "The Economic Implications of Learning by Doing" *Review of Economic Studies*, vol. 29, (1962), pp.155-173.
- Bahk B. H. and Gort, M. "Decomposing Learning by Doing in New Plants". *Journal of Political Economy*, vol. 101, no 4, 1993, pp. 561-583.
- Becker, Gary S. *Human Capital*. New York. NBER. 1964.
- Berg, I. "Education and Jobs: The Great Training Robbery". New York, N.Y. Percheron Press. 2002
- Borghans, L. & de Grip, A. (Eds.) *The Overeducated Worker?* Cheltenham, UK. E.Elgar 2000
- Braverman, H. *Labour and Monopoly Capital*. New York, N.Y. Monthly Review Press. 1974.
- Bruner, J. *Toward a Theory of Instruction*. Cambridge, Mass. Belknap Press. 1966.
- Cabral, L. M. and Riordan, M. H. "The Learning Curve, Market Dominance, and Predatory Pricing" *Econometrica*, vol. 62, no.5, (1994), pp. 1115 1140.
- Canada. Department of Manpower & Immigration. *Canadian Classification and Dictionary of Occupations*. Ottawa. 1971.
- Canada. Human Resources Development Canada. Ottawa. Prior Learning Assessment Newsletter vol. 1, no. 2, (1995).
- Coase, R.H. "The Nature of the Firm" *Economica*, vol. 4, (1937), pp.386-405
- Council on Race Relations in Canada. *Systemic Racism in Employment in Canada: Diagnosing Systemic Racism in Organisational Culture*. CRRC Website. C.2000
- Darwin, Charles. *On the Origin of Species*. London. John Murray.1859.
- Denison, Edward. F. *Measuring the Contribution of Education (and the Residual) to Economic Growth*. In OECD 1964.
- Doeringer, P.B, and Piore, M. J. *Internal Labour Markets and Manpower Analysis*. Lexington, Mass. D.C.Heath. 1971.
- Economic Council of Canada. *First Annual Review*. Ottawa. Queen's Printer. 1964.
- Fine, S. A. "The Use of the Dictionary of Occupational Titles as a Source of Estimates of Education and Training Requirements". *Journal of Human Resources*,. vol. 3, no. 3, (1968), pp 363-375
- Fox, A. *Beyond Contract: Work, Power and Trust Relations*. London. Faber & Faber. 1974

¹³ As the *corpus* of related research embraces several disciplines and is vast, this list illustrates only some of the more important or recent sources.

- Garnier, O. "La théorie néo-classique face au contrat de travail: de 'la main invisible' à la 'poignée de main invisible' ". 1984. In Salais, R. & Thévenot, L. (Eds.) *Le Travail: Marchés, Règles, Conventions*. Paris. INSEE. 1986.
- Glaser, R. *The Nature of Expertise*. Occasional Paper 107. Columbus, Ohio. National Center for Research in Vocational Education. 1985
- Gruber, H. "The Learning Curve in the Production of Semiconductor Memory Chips". *Applied Economics*, vol. 24, (1992), pp. 885-894.
- Gunderson, M. *Rethinking Productivity From a Workplace Perspective*. Ottawa. CPRN Discussion Paper W/17. 2002
- Hamper, Ben. *Rivthead: Tales from the Assembly Line*. New York, N.Y. Warner Books Inc. 1991
- Hartog, Joop. "Overeducation and Earnings: Where Are We, Where Should We Go?" *Economics of Education Review*, vol. 19, no. 2, (2000), pp.131-147.
- Human Resources Development Canada. National Occupational Classification. Ottawa. 2001.
- Human Resources & Skills Development Canada. *Readers' Guide to Essential Skills Profiles*. Ottawa. www15.hrdc-rhc.gc.ca/English/general/readers_guide_whole.asp n.d.
- Jaques, E. *The Measurement of Responsibility*. London. Tavistock Press. 1956
- Jaques, E. *A General Theory of Bureaucracy*. London. Heineman. 1976.
- Jevons, S. 1870. *The Theory of Political Economy*. 1970 edition. Harmondsworth, Middlesex. Penguin Books.
- Juravich, T. *Chaos on the Shop Floor: a Worker's view of Quality, Productivity and Management*. Philadelphia. Temple University Press. 1986.
- International Standard Classification of Occupations (ISCO). ILO. Geneva
- Kahneman, D. & Tversky, A. *Choices, Values, Frames*. New York, N.Y. Cambridge University Press. 2000.
- Koffka, K. "Perceptions: an Introduction to the Gestalt-Theorie". *Psychological Bulletin*, vol. 19, (1922), pp. 531-585.
- Kohn, Melvin & Schooler, Carmi. *Work and Personality: an Inquiry into the Impact of Social Stratification*. Ablex Publishing Corporation. Norwood, N.J. 1983.
- Krahn, Harvey & Bowlby, Jeffrey. *Education-Job Skills Match: An Analysis of the 1990 & 1995 National Graduates Surveys*. Report R-00-1-1E. Applied Strategic Research Branch. Human Resources Development Canada. 1999.
- Krahn, Harvey & Lowe, Graham S. *Literacy Utilisation in Canadian Workplaces*. Catalogue No. 89F0103XIE. Statistics Canada. Ottawa. 1998
- Kusterer, K. *Know-How on the Job: The Important Working Knowledge of 'Unskilled' Workers*. Boulder. Col. Westview Press. 1978
- Langton, H.H. (Ed.). *A Gentlewoman in Upper Canada: The Journals of Anne Langton*. Toronto. Clarke, Irwin & Company. 1966
- Lamarck, J.P.B.A. 1809. *Philosophie Zoologique*. Reprinted 1960. Codicote, Herts. England. H.R Englemann and Wheldon & Wesley, Ltd.
- Lave, J. *Cognition in Practice*. New York, N.Y. Cambridge University Press. 1988 .
- Le Bas, C. "Comment Les Ouvriers Parlent-t-ils de leur Savoir-Faire?" *Economie et Humanisme*, vol. 269, (1983).

- Lindbeck, A. & Snower, D. "Multi-task Learning and the Reorganisation of Work: from Tayloristic to Holistic Organisation". *Journal of Labour Economics*, vol. 18, no. 3, (2000), pp. 353-376.
- Livingstone, D.W. *The Education-Jobs Gap: Underemployment or Economic Democracy*. Aurora, Ontario. Garamond Press. 2004
- Lorenz, K. *Trois Essais sur le Comportement Animal et Humain*. Paris. Editions du Seuil. 1970
- Maroy, Christian & Doray, Pierre. "Education-Work Relations: Theoretical Reference Points for a Research Domain". *Work, Employment & Society*, vol. 14, no. 3, (2000), pp. 173-189.
- Marx, K. *Wages, Prices and Value Added*. Paris. La Pleiade. 1865
- McKinlay, B. Characteristics of Jobs that are Considered Common. Columbus, Ohio. Center for Vocational Education. 1976
- Meltz, N. M & Penz, G. P. *Canada's Manpower Requirements in 1970*. Canada. Ottawa Department of Manpower and Immigration. 1968.
- Miller, Ann R., Treiman, Donald J., Cain, Pamela, Roos, Patricia (Eds.). *Work, Jobs and Occupations. A Critical Review of the Dictionary of Occupational Titles*. Committee on Occupational Classification and Analysis. Assembly of Behavioural and Social Sciences. National Research Council. National Academy Press. Washington, D.C. 1980.
- Ministère de l'Éducation Nationale. *Savoirs et Savoir-Faire à l'Issue de la Scolarité Obligatoire*. Paris. France. 1978.
- OECD. *The Residual Factor and Economic Growth*. Paris. OECD. 1964.
- OECD. *Occupational Change & Transferable Skills*. Paris. OECD. Paris. 1978
- OECD. *The Role of Women in the Economy*. Paris. OECD. 1975.
- OECD. *Selection and Certification in Education and Employment*. Paris. OECD. 1977.
- OECD *Youth Unemployment*. Paris. OECD. 1978
- OECD *Youth Unemployment*. Paris. OECD. 1980
- OECD *Report on Vocational Education and Training*. Paris. OECD. 1980
- OECD *The Competences Needed in Working Life*. Paris. OECD. 1982.
- OECD *Girls and Women in Education*. Paris. OECD OECD. 1986
- Parnes, H.S. *Manpower Analysis in Educational Planning*. In Parnes (ed.) *Planning for Education and Social Development*. Paris. OECD. 1963
- Polanyi, M. *Personal Knowledge*. London. Routledge & Kegan Paul. 1958.
- Polanyi, M. *The Tacit Dimension*. Garden City NY. Doubleday. 1966.
- Popper, Karl *The Logic of Scientific Discovery*. New York. N.Y. Basic Books. 1959.
- Prais, S. & Wagner, K. *Schooling Standards in Britain and Germany: Some Summary Comparisons Bearing on Economic Efficiency*. Discussion Paper no 60. London. National Institute of Economic & Social Research. 1983
- Pratzner F.C. and Stump, R.W. *Occupational Change and Transferable Skills: An Empirical Analysis*. Paris. OECD. 1978
- Pawlow, J.P. "The Scientific Investigation of the Psychical Faculties or Processes in the Higher Animals". *The Lancet*, vol. 168, no. 4336, (1906), pp. 911-915.
- Ravèyre, M-F. "Un Savoir-Faire en Sursis". *Economie et Humanisme*. Lyon. vol. 269, (1983).

- Romer, P.M. "Increasing Returns and Long-Run Growth". *Journal of Political Economy*, vol. 94, no. 5, (1986), pp. 1002-1037
- Rose, M. "The Working Life of a Waitress". *Mind, Culture and Activity*, vol. 8, no. 1, (2001), pp. 3-27.
- Rosen, S. "Learning by Experience as Joint Production". *Quarterly Journal of Economics*, vol. LXXXVI, (1972), pp. 366-382.
- Schranck, Robert. *Ten Thousand Working Days*. Cambridge, Mass. MIT Press. 1978
- Schultz, Theodore W. "Capital Formation by Education". *Journal of Political Economy*, vol. 67, no. 6, (1960), pp. 571-583.
- Scribner, Sylvia. *Thinking in Action: Some Characteristics of Practical Intelligence*. In Sternberg & Wagner. 1986.
- Shiffrar, M., Li, X., & Lorenceau, J. "Motion Integration Across Differing Image Features". *Vision Research*, vol. 35, (1995), pp. 2137-2146.
- Simon, H.A. "A Formal Theory of the Employment Relationship". *Econometrica*, vol. 19, no. 3, (1951), pp. 293-305.
- Simpson, I.H. "The Sociology of Work: Where Have the Workers Gone?" *Social Forces*, vol. 67, no. 3, (1989), pp 563-581.
- Sjogren, D.C. *Occupationally Transferable Skills and Characteristics: Review of Literature and Research*. Columbus, Ohio. Center for Vocational Education. 1977.
- Smith, A. *An Inquiry into the Nature and Causes of The Wealth of Nations*. 1776
Ed. Cannan, E. 6th edition. London. Methuen. 1950.
- Smith, Arthur. *Generic Skills: Keys to Job Performance*. Ottawa. Canada Employment and Immigration Commission. 1978.
- Solow, R.M. *Learning from "Learning by Doing": Lessons for Economic Growth*. Stanford, Ca. Stanford University Press. 1997.
- Spenner, K. "Deciphering Prometheus: Temporal Change in the Skill Level of Work". *American Sociological Review*, vol. 48, no. 6, (1983), pp. 824-837.
- Spenner, K. "Skill: Meanings, Method, and Measures". *Work & Occupations*, vol. 17, no. 4, (1990), pp. 399-421.
- Statistics Canada. *Flux: Two years of Life in the Canadian Labour Market: Findings of the Statistics Canada Labour Market Activity Survey 1986-87*. Report 71-538E. Ottawa. Statistics Canada. 1987.
- Sternberg et al. *Practical Intelligence in Everyday Life*. New York. N.Y. Cambridge University Press. 2000
- Sweetman, A. "Working Smarter: Education and Productivity". *Review of Economic Performance and Social Progress*, (2002), pp. 157-180.
- Thomas, A.M. *Prior Learning Assessment: The Quiet Revolution*. In Wilson, A.L. and Hayes, E.R. (Eds.) *Handbook of Adult and Continuing Education*. San Francisco. Jossey-Bass. 2000.
- Tough, Allen M. *The Adult's Learning Projects: A Fresh Approach to Theory and Practice in Adult Learning*. Research in Education Series No. 1. Toronto. Ontario Institute for Studies in Education. 1971
- United States Department of Labour. Bureau of Employment Security. *Worker Trait Requirements*. Washington, D.C. 1956
- United States Department of Education. *A Nation at Risk*. Washington. D.C. 1983.

- Vahey, Shaun P. "The Great Canadian Training Robbery: Evidence on the Returns to Mismatch". *Economics of Education Review*, vol. 19, (2000), pp. 219-227.
- Vallas, S.P. "The Concept of Skill: A Critical Review" *Work & Occupations*, vol. 17, no. 4, (1990), pp. 379-398.
- Weale, M. "A Critical evaluation of Rate of Return Analysis". *Economic Journal*, vol. 103, no.418, (1993), pp. 729-737.
- Wertheimer, M. "Experimentelle Studien uber des Sehen von Bewegung". *Zeitschrift fur Psychologie*, vol. 61, (1912), pp. 161-265.
- Williamson, O. E. *The Economic Institutions of Capitalism*. London. Macmillan. 1985.