

# Literacy Skills and Schooling from the International Adult Literacy Survey\*

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**Abstract:** In the information age, literacy skills are becoming increasingly important in the knowledge economy. The use of new technologies in everyday life, changing demands in the labor market, and participation in the globalization process all require higher literacy skills. Although literacy skills are related factors such as demographic characteristics, ethnicity, and language background, schooling has been perceived as a key determinant of literacy skills. This paper reviews important texts in the area of literacy skills and schooling. In addition, relying on the IALS data, this paper identifies relationships between schooling and literacy skills in 20 countries. The article concludes with a discussion of policy implications for improving literacy skills and future research for nonlinear relationships between schooling and literacy skills and endogenous effects of schooling on literacy skills.

**Keywords:** Literacy skills, schooling, knowledge economy

## INTRODUCTION

Literacy is a key instrument of economic and social power. It embodies the skills and cumulative learning that are essential to economic growth (Becker, 1964; Romer, 1993) and human development (Sen, 1999). In recent years, literacy skills have become increasingly important in the knowledge-based economy (OECD & Statistics Canada, 1997, 2000). It is now widely recognized that individuals, firms, and nations face intense pressure to enhance their skills in the global economy (Thurow, 1992).

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Literacy skills also have numerous policy implications for human resources, labor market, employment, and education and training policies (Berryman, 1994; Rivera-Batiz, 1992; Stern & Tuijnman, 1994). A recent trend toward widening inequality in employment and earnings between more and less skilled workers in many developed countries has generated considerable concern about literacy skills (Blau & Kahn, 2001; Freeman & Schettkat, 2001). In addition, literacy skills have sweeping policy implications for other dimensions of economic and social life, such as civic participation (Kaplan & Venezky, 1994), health (Bresolin, 1999; Gazmararian et al., 1999), crime prevention (Haigler, 1994), and the administration of justice (Root & Stableford, 1999; Wallendorf, 2001).

The increasing demand for high literacy skills raises important policy questions about how to develop and sustain literacy proficiency. Improving the literacy skills of the population is increasingly a challenge for policy makers. Although research has addressed the fundamental importance of the quality and quantity of education for raising the overall literacy level of nations, relatively few empirical studies have connected education and literacy skills. Though there is abundant evidence to indicate that students make significant gains in literacy skills within school, relatively little is known about literacy skills once individuals are separated from educational institutions. The long-term effects of schooling on literacy skills are also still unknown.

Literacy surveys in both developing and developed countries provide research opportunities for a better understanding of the relationship between schooling and literacy skills.<sup>1</sup> For instance, one recent study, using the International Adult Literacy Survey (IALS), suggested that schooling is the main determinant of literacy skills (OECD & Statistics Canada, 2000). It showed that schooling is the strongest predictor for 17 of the 20 IALS countries. On average, each additional year of school attended corresponds to an increase of 10 points on the literacy scores on the IALS test. In addition, Willms (1996) showed that each year of schooling translates into increased literacy scores of about 12% to 13.5% of one standard deviation for Canadian youth ages 16-25. In sum, schooling is perceived as one of the most important factors in the litera-

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1. Literacy surveys in the United States include the 1983 Youth Adult Literacy Survey and the 1992 National Adult Literacy Survey. In developing countries, surveys include the 1991-92 Living Standard Survey in Ghana and the 1990-91 Living Standards Measurement Survey in Morocco (Bluch & Verner, 2000; Kirsch, Jungeblut, & Kolstad, 1993; Lavy & Spratt, 1997). Furthermore, the Organisation for Economic Co-operation and Development provided a comparative literacy survey, the International Adult Literacy Survey, covering 20 countries from 17 Western industrialized countries and four Eastern European countries (Poland, Hungary, Czech Republic, and Slovenia) and one developing country (Chile) from 1994 to 1998 (OECD & Statistics Canada, 2000).

cy production function.

This paper examines recent empirical findings regarding the effects of schooling on literacy skills and suggests policy implications for improving literacy skills. This paper consists of three sections. First, this paper discusses how a variety of concepts of literacy are related to schooling. Second, this paper reviews theories and empirical evidence about the effects of schooling on literacy skills. In addition, this paper examines two significant yet neglected issues regarding the effects of schooling in literacy production functions: the nonlinear relationship between schooling and literacy skills and the endogeneity of schooling. Finally, this paper suggests policy implications from the academic findings about the relationship between literacy skills and schooling.

## LITERATURE REVIEW: LITERACY SKILLS AND SCHOOLING

### Concepts of Literacy and Schooling: Two Competing Paradigms of Literacy

Although it is difficult to define literacy in universal terms, concepts of literacy can be divided into two major competing paradigms: the autonomous model and the contextual model. The role of schooling differs in these two literacy paradigms. The former model tends to emphasize the effects of schooling, whereas the latter model emphasizes the limitations of schooling and the interaction between schooling and nonschooling factors.

#### Autonomous Model

The autonomous model emphasizes the cognitive distinction between literates and nonliterates and the evolutionary consequences of literacy as a technology of the intellect (the "great divide"). According to this model, the cognitive development derived from literacy activities induces intellectual transformation toward modernity or civilization and economic development (Goody, 1968), such that literacy activities facilitate logical thought and decontextualized thinking. The cognitive nature of literacy is universally independent of social context (Goody, 1968; Ong, 1982).

In this model, literacy is understood as an objective, quantifiable category that refers to the basic ability to read and write, and it is evaluated in a seemingly value-neutral way. This psychometric model is consistent with the development of intelligence tests in the early part of the twentieth century, which changed the concept of literacy as the basic cognitive skills usually acquired in school. Because the model assumes that people are similar in the way they learn and that teaching is the same for everyone, schooling is commonly assumed to be a major source of literacy skill development.

### **Contextual Model**

The contextual model calls into question the decontextualized cognitive view of literacy (Graff, 1979; Heath, 1983; Scribner & Cole, 1981). Rather, this model argues that literacy is not only a cognitive process occurring at the individual level but also a social and cultural one. Literacy cannot be viewed apart from the social and political context in which it is learned. Literacy is regarded as a set of social practices (Auerbach, 1993) rather than skills or abilities.

The contextual dimension of literacy provides the notion of multiple literacies (Bloome, 1987; Street, 1984). The plurality of literacy considers a variety of literacy activities, including family literacy, schooled literacy, community literacy, and specific functional literacies such as computer literacy, scientific literacy, statistical literacy, and media literacy.<sup>2</sup> In this model, the term “literate” has no universally accepted definition. Literacy needs to be measured and judged according to the needs of each society. The scope and level of literacy depend on the contexts of the type of literacy and how it is used.

According to the contextual model, being literate means more than just encoding or decoding technical symbols acquired in school. Although schooling is critical to the development of literacy, it is not, by itself, sufficient. Historians have shown that the level of literacy produced by the schools of any society is directly tied to the functions and levels of literacy in the society as a whole (Graff, 1979). Furthermore, the plurality of literacy recognizes the nonschooled literacies associated with different mediums and tools. This implies that the transfer of literacy abilities acquired in school may be severely limited by differences in literacy contexts, and literacy instruction must begin with the learner’s social reality in order to provide a context for individuals to engage in activities in which literacy is constructed and used. Consequently, it is unrealistic to expect that a modern, literate society could be created simply by establishing schools and teaching children to read.

Recent research has stressed the role of specific knowledge, functional contexts,

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2. For example, information literacy can be defined as a set of abilities requiring individuals to “recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information.” Statistical literacy can be defined as “the ability to understand and evaluate statistical results that permeate our daily lives” (Wallman, 1993). Scientific literacy can be defined, in part, as the ability to develop and express reasoned positions on scientific matters (Pearson, 1990). And computer literacy can be defined as the ability to use the computer as a tool, determine the need for programming skills, and assess the socioeconomic implications of computer use (Haigh, 1985). In a similar way, other areas of technical competence such as media literacy and digital literacy can be defined as a high level mastery of subject or discipline literacies.

and social interactions in cognition, as well as schooling alone. For instance, Sternberg (1997) argued that although the basic information-processing components underlying abstract analytical and practical cognitive skills are the same (e.g., defining problems, formulating strategies, inferring relations, and so on), differences in the tasks and situations that require these two kinds of cognitive abilities can yield different relationships between schooling and the two kinds of tasks. In Kenya, for example, schoolchildren whose traditional skills were most valued by the community tended to do least well in school tests (Sternberg & Grigorenko, 1997). In Brazil, street children who were successful at conducting street business were found to have little ability to do school mathematics (Ceci & Roazzi, 1994). These cases imply that people who apply a set of processes well in one context may not apply them well in another.

### Functional Literacy, Critical Literacy, and Schooling

#### Functional Literacy and Schooling

The definition of “functional literacy” varies from place to place and with types of tasks. In its simplest sense, a functionally illiterate individual is one “who cannot engage in all those activities in which literacy is required of 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.” The terms “functional literacy” and “basic literacy” are used interchangeably here to indicate literacy at a general level. In recent years, basic functional illiteracy in developed countries has become a matter of global concern.

The concept of functional literacy initially attempted to give literacy a socioeconomic imperative. The notion was also fostered by a growing interest in education as the provision of training needs or “life skills” rather than a foundation for the future acquisition of skills. An interest in functionality was stimulated by development projects that saw a lack of education as a barrier to economic development.

However, there is a gap between schooled literacy skills and functional literacy skills. Because the concept of functional literacy emerged to describe the use of basic skills in specific contexts, contexts in school are likely to be separated from those practices in functional skills (Resnick, 1990). Recent studies have confirmed that the purpose, effects, and types of literacy acquired in nonschool settings differ greatly from those among schooled populations. Functional literacy may not be compatible with the academic literacy (or schooled literacy) taught in school literacy programs. Schooled literacy is based on the cognitive processing approach, which is related to elementary and secondary assessment and instruction in schools; functional literacy, on the other hand, is based on materials and task approaches related to home, work,

and civic functioning. The tensions associated with the incongruence between school and community literacies have been well documented in the literature (Au & Mason, 1981; Foster, 1992; Heath, 1983). Some people and some communities and families may reject literacy learning in school settings (Ogbu, 1991). But school is only one of many social forces that determine the nature and extent of a nation's literacy. To understand the literacy crisis and possible solutions to it, it is essential to examine the nature of literacy practice outside school, as well as within.

### **Critical Literacy and Schooling**

From a critical perspective, literacy is defined as empowerment and the ability to bring about change in inequities and injustices in society. According to this view, literacy has been a potent tool in maintaining the hegemony of elites and dominant classes in certain societies (Goody, 1968).

Critical literacy theory emphasizes that schooling should not only reinforce but also challenge oppressive social relations. It relates education to social action, linking critical reflection with research, mobilization, and organizational strategies. For instance, Freire (1973) criticized the "banking theory of schooling," whereby the teacher provides the child with a lot of "rote-learned" information. This conservative approach, according to Freire, numbs the critical capacities of students and preserves the oppressor class. In this view, literacy work is generally recognized as most effective when it is undertaken in the context of community-based organizations and least effective when it is directly managed by large, bureaucratic systems of schooling (Hunter & Harmon, 1979).

### **Characteristics of Literacy Skills in Literacy Surveys**

Most measures and concepts of literacy skills have been developed in the United States. In particular, recent definitions in literacy surveys focus on the effective or critical application of cognitive skills. It appears that adult literacy surveys in the United States measure literacy skills as cognitive skills, especially information-processing skills that are closely related to daily life functions.

The Adult Performance Level study began in 1971 as a project funded by the U.S. Office of Education. It introduced the concept of "competency-based" education to the field of adult basic education. The term "competency-based" means that adult basic education is focused on achieving measurable outcomes. In 1985, the National Assessment of Educational Progress began to study the literacy skills of young adults (21-25 years old) living in households in the 48 contiguous United States. Like all previous surveys, the 1985 survey measured literacy scores using scale scores for three domains

of literacy tasks: prose, document, and quantitative literacy tasks. The scale scores for each of the three types of literacy task domains ranged from 0 to 500, with the majority of tasks (items) falling between 200 and 400. The 1992 National Adult Literacy Survey (NALS) used the same prose, document, and quantitative scales used in the Young Adult Literacy Survey (YALS). Many of the same test items that were used in the YALS were also used in the NALS. These literacy categories are much like the categories used by the military since World War I to categorize a range of scores obtained by young adults into categories of "intelligence" in the army alpha and beta tests, "general learning ability" in the Army General Classification Test, and "trainability" in the Armed Forces Qualification Test (AFQT).

Both the 1992 NALS and the 1994-98 IALS adopted information-processing skills of a more cognitive nature compared to conventional measures of literacy skills. In these surveys, the term "literacy" means more than the ability to read and write—it refers to a person's ability to "use printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential" (Kirsch et al., 1993; OECD & Statistics Canada, 1995, 1997, 2000).

The definition of literacy skills goes beyond simply decoding and comprehending text and requires a broad range of information-processing skills that adults use to accomplish the range of tasks associated with work, home, and community contexts. Kirsch and Mosenthal (1992) suggested that the skills required to complete each task in the NALS are beyond conventional reading and writing abilities. This implies that the measure of literacy used in the NALS requires more skill and ability than the traditional definition. Although there is much controversy regarding the definition of literacy, this definition has been mostly accepted by the policy community.<sup>3</sup>

The information-processing approach suggests that literacy skills are the result of an active, constructive process on the part of the learner working with information from the internal or external environments (Sternberg, 1988). This suggests that literacy skills are based on a cultivating environment for active information seeking, mental representation to bring a larger share of prior knowledge to bear on the learning task, and further development of learning. These literacy skills can be taught and trained; they are neither fixed nor singular, as the psychometric view assumes. The improvement of literacy skills is dependent on environmental influences and individual effort,

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3. For example, the U.S. Congress incorporated a similar definition into the National Literacy Act of 1991, in which literacy was defined as "an individual's ability to read, write, and speak in English and compute and solve problems at levels of proficiency necessary to function on the job and in society, to achieve one's goals, and to develop one's knowledge and potential."

not simply aptitude.

The information-processing paradigm suggests that students who stay in school learn more than students who drop out and that students who take more math classes learn more mathematics, as do students who do more homework. Similarly, the approach supports the practice of literacy tasks outside school. However, it is uncertain to what extent initial schooling is related to the literacy skills measured in nonacademic contexts. The information-processing approach suggests that depending on the test taker's familiarity with tests, the level of literacy skills reflects something about how proficient test takers are at adapting to an environment. If less educated people are more familiar with these literacy tasks, they are more likely to get higher literacy scores than more educated people who are not familiar with the tasks. In this case, the relationship between initial schooling and literacy skills is likely to be confounded by the familiarity of literacy tasks.

## **SCHOOLING EFFECTS: THEORIES AND EMPIRICAL EVIDENCE**

This section summarizes some of the theories and evidence regarding how schooling influences literacy skills. The section will not review all theories and evidence regarding the effects of schooling on literacy skills. Rather, it examines several relevant theories and evidence of schooling effects. The literature review relies on interdisciplinary studies about cognitive skills from anthropology, linguistics, psychology, and sociology. This seems to be reasonable because recent measures of literacy skills are very similar to cognitive skills. It must also be recognized that most studies in this area are mainly observed in the context of a particular U.S. education and social system.

### **Explanations for Schooling Effects**

#### **A Brief Review: Schooling Effects**

One long-standing hypothesis is that schooling augments productivity by enhancing the ability of individuals to learn. Cognitive development studies in various disciplines have devoted considerable attention to whether formal schooling has an impact on cognitive growth. There is, at present, a certain consensus that formal schooling in the Western model affects a variety of cognitive skills ranging from logic and reasoning to memory and perceptual skills. Schooling, a key type of measured human capital in social science research, has been shown to affect earnings, occupation, and health, at least in part because of the skills imparted in school. It is, however, difficult to find a comprehensive review to cover the full spectrum of how schooling influences literacy



skills. This section focuses on the major theories and some of the empirical evidence addressing how schooling influences literacy skills.

Overall, the determinants of literacy skills can be divided into three dimensions: (1) the internal world of literacy production, (2) the world of individual experience in literacy production, and (3) the external world of literacy production. The determinants of literacy skills in the internal world include an individual's ability (e.g., intelligence). Psychological factors such as motivation and commitment to literacy activities are involved in the world of individual experience in literacy production. The external world of literacy production covers environmental factors from school inputs (e.g., the quantity and quality of schooling), family inputs (e.g., family income and parental education), and social inputs (e.g., culture, religion, poverty). It is, however, beyond the scope of this study to review the determinants of literacy skills regarding these three dimensions. Rather, this study focuses on the effects of schooling on literacy skills while considering how the effects of schooling depend on nonschooling factors in these three dimensions. There are several types of theories regarding schooling's effects on literacy skills. Theories that posit the positive effects of schooling include cognitive training, expanding the knowledge base, building more learning opportunities, socializing aspects, and rational investment in human capital.

#### **Cognitive Development Theory**

Highly educated people may display greater cognitive flexibility and problem-solving skills than poorly educated people. Cognitive psychological studies have found that exposure to formal educational experiences produces abstracting and generalizing ability (Greenfield, 1966) and logical expressions of formal operational thought (Olson, 1977). Bruner (1966) pointed to the use of the written form of language in school, which facilitates linguistic competence and thus symbolic functions in general. Scribner and Cole (1981) found that certain thinking patterns may be more attributable to the schooling process than learning how to read and write.

#### **Theory of Expanding Knowledge**

Individuals with more schooling have greater knowledge about a wider range of areas than their less educated peers. There is considerable evidence that individuals who obtain more schooling are more knowledgeable about current events and public issues than individuals who receive less schooling (Smith, 1995). Hirsch (1987) also emphasized that background knowledge improves reading efficiency. Although the mechanism by which schooling is presumed to impart specific knowledge is not articulated, one explanation is that schooling creates an enduring receptivity to learning across the life course. In sum, individuals with more schooling have access to a richer

array of information than those with less schooling. They know more about their social, cultural, and political worlds and can apply that knowledge to shape their futures.

### **Theory of Learning Opportunities**

People with more education are more likely to engage in problem solving in daily life than those with less education. For example, college graduates are more likely to participate in both formal and informal adult education than high school graduates (Hyman et al., 1975). Well-educated people are more likely to be aware of such opportunities for further education and more likely, by virtue of their earlier success in school, to feel confident that they can benefit from them. In addition, individuals with more schooling are more open to new ideas and more likely to adopt innovations than those with less schooling. Wozniak (1987) reported an analysis from the Iowa Family Farm Research Project Survey showing that farmers with more schooling were more likely to adopt innovative technology sooner than farmers with less schooling. Wozniak suggested that better educated farmers may have more information about agricultural innovations than less educated farmers. In addition, schooling is associated with adult social life and the provision of learning opportunities. Smith (1995) reported that in the 1987 General Social Survey, individuals with more schooling were found to belong to a larger number of voluntary groups and engaged in a greater number of organizational activities compared to those with less schooling. Schooling enables individuals to enter supportive social relationships with a range of others.

### **Socialization Theory**

Socialization theory suggests that schooling has a strong socializing influence on individuals' disposition toward learning. According to this theory, schooling provides knowledge and shapes behaviors and personality traits that are favorable for the development of literacy skills. In this view, schooling confers knowledge about the world and provides individuals with the cognitive tools to manipulate this knowledge so as to maximize their well-being by solving problems and adapting to new situations. For instance, studies (Hyman, Wright, & Reed, 1976; Spaeth, 1976) have suggested that schooling provides flexible, rational, and complex strategies that are useful for the development of cognitive skills. In addition, schooling can transform individuals' value preferences, shaping what they judge to be important enough to attend to in their social worlds. Ross and Mirowsky (1989) argued that schooling increases an individual's psychological well-being, such that highly educated individuals are likely to feel in control of their lives and, in turn, to try to understand problems.

### **Human Capital Theory**

Human capital is the skills and knowledge of an individual (Becker, 1964). The theory of human capital assumes that schooling has a generally cumulative effect on both the cognitive and motivational aspects of one's capacity for productive work and hence human capital through higher earnings (Becker, 1964). The underlying model is one in which self-interested individuals invest in their own human capital because of its later pecuniary returns. Individuals differ in the degree to which they invest in themselves, then, either because their genetic endowments (which affect how quickly they learn skills) affect their perception of which investments are worthwhile, or because of differences in their discount rates-how much they value present versus future utility. Investment in human capital may come from schooling, job experience, or on-the-job training.

However, the human capital theory does not specify a direct link between schooling and literacy skills. Thus, it needs an adequate theory of how literacy skills are developed from other disciplines. For instance, developmental psychologists claim that early environments are very important determinants of basic capabilities, in part because some things are learned more easily at an early age. This makes clear that the optimal time and setting for much learning is much earlier than one at which the individual could possibly understand the benefits of self-investment. The optimal timing for learning will necessarily rely on someone else guiding the child, which conflicts with the image of an autonomous adult making self-interested investment decisions.

Another problem of the human capital theory is tautological. In this view, people operate rationally with the information they have and decide whether to invest in more information using the same rational, optimizing logic applied to other investment decisions. Consider, however, the implications of the fact that one part of learning cognitive skills is learning to make logical inferences from information. Thus, being a rational agent requires cognitive skills. In this theory, self-investment in education is based on a rational choice for more utility in order to increase literacy skills, while the optimal choice for the investment requires appropriate literacy skills. Thus, literacy skills and schooling are simultaneously determined.

### **Empirical Evidence for Schooling Effects**

In the past several decades, there has been considerable debate about the effects of schooling on cognitive skills. This debate was reignited by the publication of *The Bell Curve*, in which Herrnstein and Murray claimed that schooling has little or no effect on cognitive skills. However, numerous quasi-experimental studies have confirmed the causal effects of schooling on cognitive skills after controlling for ability (for a

broad review, see Ceci, 1991). There are two different types of research in this area.

One body of research focuses on comparing individuals with schooling and individuals without schooling. This research has often been conducted in developing countries. The research suggests that school practices lead to general cognitive skills compared to community practices outside school. The other body of research attempts to differentiate schooling in terms of macro social conditions in order to eliminate unobserved individuals' abilities and to exploit exogenous schooling differences. In this tradition, quasi-experimental studies across countries have found a strong causal effect of schooling on cognitive skills in terms of exogenous schooling differences (such as intermittent school attendance, delayed school startup, discontinued schooling, and early birth date).

### **Schooling versus No Schooling**

Scribner and Cole (1981) made use of a natural experiment provided by the Vai people of Liberia to examine the effects of literacy separately from those of education. The Vai-speaking people have developed an indigenous script that is widely used but not learned in school.<sup>4</sup> In this ideal comparative laboratory, the researchers attempted to compare the test performance of the literate Vai people with that of the nonliterate Vai people to determine whether literacy substitutes for schooling in producing widespread effects on test performance and whether this is an effect that is general to all literacies. The groups compared consisted of nonliterate men and men literate in Vai script, Arabic, or English.

According to Scribner and Cole's findings, schooling had the strongest effects on general cognitive skills such as abstract thinking, memory, taxonomic classification, and logical processes. By contrast, the effects of nonschool literacies were little, implying that literacy does not produce general cognitive effects. These results suggest that schooling's widely observed effect on general cognitive performance does not derive from equipping children with written language.

In addition, Scribner and Cole (1981) tested specific functional skills inferred to be promoted by the particular literacies. They supported the idea that specific activities involved in the use of a particular literacy facilitate the development of specific cognitive skills related to particular literacy practices. For instance, Qur'anic literates per-

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4. Approximately 20 percent of Vai men are literate in Vai script, which is informally taught for business needs outside any institutional setting; 6 percent are literate in English learned in Western-style schools and 16 percent are literate in Arabic, which is learned in religious schools and used to read Muslim scriptures with the outside world. Women are generally not literate in any script.

form well on incremental recall tests, a reflection of the importance of memory work in Qur'anic schools. Subjects literate in the Vai syllabary perform well in rebus-solving tests because using the Vai syllabary involves rebus-like problems. Vai subjects literate in English who attend Western-style schools do well on tests that resemble school activities such as syllogisms. These findings suggest that the pedagogical practices that characterize each literacy experience shape the individual's cognitive performance: particular literacy practices promote particular skills (Scriber & Cole, 1981: 258).

Other studies suggest that modern schooling involves specific literacy skills compared to nonschooling and traditional schooling populations. For instance, Bruner (1964) found differences between village children with a few years of schooling and uneducated children on a variety of classification and Piagetian reasoning tasks among the Wolof of Senegal. School children who had attended school longer were more likely to form and function than were the unschooled children. Greenfield and Bruner (1966, 1971) showed that Wolof schoolchildren performed more like Boston school children on these tasks than like their unschooled brothers and sisters. Vygotsky (1962) showed that school populations give more accurate verbal descriptions of their classifying operations and rules of solution than their unschooled counterparts. Luria (1971) found similar changes in concept formation associated with a change from informal to formal education among central Asian peasants. Kohn and Schooler (1978) found that the number of years of schooling is highly correlated with Kohn's ideational intellectual flexibility but weakly related to perceptual intellectual flexibility. Inkles and Smith (1974) found that in six developing countries, elementary education had a greater impact on literacy than experience. Wagner and Spratt (1987) found positive effects of Qur'anic schooling on serial memory but not on other memory or cognitive tasks.

### **Less Schooling versus More Schooling**

To date, there are no quasi-experimental studies using adult literacy skills. However, numerous quasi-experimental studies have found that additional schooling increases cognitive test scores such as academic test scores, intelligence scores, and AFQT scores. Because there is a high correlation between these cognitive skills and adult literacy skills (Kirsch & Morsenthal, 1990; Jensen, 1998), it seems reasonable to use these studies as indirect evidence of the causal effects of schooling on literacy skills.

Previous studies have found that additional schooling does increase cognitive skills.<sup>5</sup> For instance, in their study of children reared in the hollows rimming the Blue

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5. For a review of this literature, see Ceci (1991).

Ridge Mountains in the western area of Washington, D.C., Sherman and Key (1932) observed that the test scores of the hollow children varied systematically across the level of schooling available in their hollows. Advantages of 10-30 points were found for the children who had received the most schooling. Tyler (1965) also reached a similar conclusion, showing that the IQs of children born in 1940 in a mountainous area of Tennessee were, on average, 11 points higher than the IQs of their siblings born in 1930. Tyler rejected a genetic explanation for this improvement in favor of one emphasizing the increased educational and economic opportunities developed during the decade in question.

Ramphal (cited in Vernon, 1969) studied the intellectual functioning of children of Indian ancestry whose schooling had been delayed for up to four years because of the unavailability of teachers in their village. Compared with children from nearby villages inhabited by Indian settlers of similar genetic stock who had been fortunate enough to have teachers, children whose schooling had been delayed experienced a decrement of five IQ points for every year of delay. In the Netherlands during World War II, many schools were closed as a result of the Nazi occupation, and many children entered school several years later. These children's IQs dropped approximately 7 points, probably as a result of their delayed entry into school (DeGroot, 1951). Much of this decrement was ultimately recovered by those who remained in school.

Harnqvist (1968) selected a 10 percent random sample of the Swedish school population born in 1948 who, at the age of 13, were given IQ tests. When they reached the age of 18 in 1966, 4,616 of these Swedish men were retested as part of their country's national military registration. Harnqvist found that for each year of high school not completed, there was a loss of 1.8 IQ points, up to a maximum difference of nearly 8 IQ points between two adolescents who were similar in IQ and grades at age 13. In Husen's study, a comparison of 613 Swedish boys who were tested in the third grade in 1938 and again at the time of military registration in 1948 indicated that completing junior high school was associated with a 3 point advantage, whereas completing secondary school yielded an 8 point advantage.

Crone and Whitehurst (1999) found that children who began school a year earlier than their same-age peers outperformed those peers on measures of both emergent literacy skills and early reading skills.<sup>6</sup> The impact of a year of schooling on emergent

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6. This study examined the effects of age and schooling on the emergent literacy and early reading skills of 337 children from low-income backgrounds. Every child in the study was initially enrolled in a Head Start classroom on Long Island, New York. Children were followed longitudinally from the end of preschool to the end of the first grade. A subset of the sample (N = 183) was followed through the end of the second grade.

literacy skills was 1.7 times greater than the impact of other processes associated with age. The impact of a year of schooling on early reading was 4.3 times stronger than the effect of age. The impact of an additional year of schooling on the development of early reading skills was much stronger than the impact of age-related differences in emergent literacy skills. This study suggests that differences between the youngest and oldest children in preschool and Head Start can be eliminated by providing reading instruction in first grade and that the effects are not transitory. In addition, Morisson, Smith, and Dow-Ehrensberger (1995) found that although children improved slightly before the first grade, the greatest advances in this important skill occurred after participants had experienced a year of formal reading instruction.

In the United States, Neal and Johnson (1996) examined the relationship between schooling and AFQT scores using different birth dates in the same year as instrumental variables. Within a given birth year, the number of years of schooling completed was the same for those born during the first nine months of the year, but the amount of schooling attendance dropped off for those born during the final three months of the year. These individuals were statistically more likely to enter school a year later as a result of having been born late in the year compared to the rest of their birth year cohort. The cause of low AFQT scores among students with late-year births was entirely a function of their being more likely to attend school one fewer year than their peers born during the first nine months of the year. Using quarter of birth as an instrument for years of schooling completed, Neal and Johnson found that an additional year of schooling raised AFQT scores for men and women by 0.22 and 0.25 standard deviations, respectively.

Additional studies (Batles & Reinert, 1969; Proctor, Black, & Feldhusen, 1986) have used differences in enrollment age induced by compulsory school laws to estimate the effects of additional schooling on cognitive skills. Because compulsory schooling laws require children to stay in school until a certain age, children who enroll in school at a young age are required to get more schooling than those who enroll when they are older. Children who enter school at a young age are exposed to formal learning at a young age. If children learn more when they are exposed to learning at an early age, children who enroll in school earlier will get higher test scores than children with the same amount of schooling who enroll later.

Cahan and Cohen (1989) used cohort-sequential analysis to show that exposure to schooling increased both crystallized and fluid measures of intelligence. They looked at more than 11,000 Israeli fourth, fifth, and sixth graders, comparing children who differed in age by only a couple of weeks but were in different grades because of the birthday cutoff for entering school in a given year. They found that the effect of one year of schooling was larger than the effect of one year of age.

Recent longitudinal studies in the United States have also found that schooling produces an increase in cognitive skills. Using the National Longitudinal Survey of Youth, Winship and Korenman (1999) found that a year of schooling increased AFQT scores by about 0.18 standard deviation. Jencks and Phillips (1999), using the data of *High School and Beyond*, found that students who stayed in school rather than dropping out learned about 0.6 more math items and 0.8 more verbal items between the 10th and 12th grades, independent of their family backgrounds.

### **Schooling Effects from Previous Cross-Sectional Literacy Surveys**

All previous studies using literacy skills data have reported the positive effects of schooling on literacy skills in both developing and developed countries. However, they have neglected two issues: the nonlinear effects of schooling and the endogeneity of schooling. The effects of schooling may not simply add up to the effects of students' endowments because people are likely to differ, by ability and by effort, in how much they learn. Some years of schooling are not effective because of dropping out, poor school quality, or familiar or community problems outside school. In addition, the effects of schooling in the cross-sectional data are likely to be biased because of some unobserved factors that influence both literacy skills and schooling. The following provides a brief summary of the effects of schooling from the previous cross-sectional studies.

Buswell's study (1937) of adult literacy in Chicago showed that both literacy skills and practice increase as years of education increase. This suggests that one function of education is to guide readers to read more and that reading more leads to greater skill. In turn, this may lead students to be more successful in school and to pursue further education, thus leading to greater reading practice and greater skill, and so forth. The Adult Functional Reading Study of 1973 and the YALS also showed that people with more education have higher reading skills and that people who read the newspaper more often also have higher reading skills. Again, the NALS of 1992 found that people with more education have higher reading skills and that people who read the newspaper more often also have higher reading skills. All of these surveys point to the earlier findings that skill, practice, and education are interrelated.

In addition, using Statistics Canada's survey of Literacy Skills Used in Daily Activities, Charette and Meng (1998) showed that schooling has a positive and statistically significant effect on literacy. There is some evidence that the impact of years of schooling on literacy is smaller for women than for men. Other studies in less developed countries such as Morocco (Lavy & Spratt, 1997) and Ghana (Blunch & Verner 2000) simply suggest the strong positive effect of schooling. For instance, Lavy and



Spratt (1997), using the 1990-91 Living Standards Measurement Survey in Morocco, found that schooling has a strong positive effect on literacy level after controlling for parents' literacy level, region, and age. They found that completing five years of schooling (equivalent to graduating from primary school before the 1990 change in the education system in Morocco) led to an increase in the literacy index of one level—for example, from level 0 to level 1.<sup>7</sup> The strong positive relationship of schooling to literacy suggests that school attendance and persistence are likely to be effective in reducing illiteracy among school-age children in Morocco.

### **Evidence of Schooling Effects from the IALS**

Literacy skills are, to a large extent, acquired in school. There appears to be a strong relationship between education and literacy skills in every country (See Tables 1 and 2). In all countries, those with more education have higher average literacy scores. However, the difference in literacy scores between those with tertiary education and those with secondary education varies across countries. For instance, the difference in scores between them is larger in the United States than in other countries. The gap of prose literacy scores between those with completed tertiary education and those with only completed upper secondary education is about 43.2 (313.4 - 270.2) in the United States, whereas it is about 16.3 (321.8 - 305.5) in the Netherlands and 16.4(309.9 - 293.5) in Canada. It appears that Germany shows a weak link between educational attainment and literacy scores at all levels of education. These patterns of relationships between education and prose literacy scores are almost the same as those between education and quantitative literacy scores.

**Table 1.** Prose Literacy Scores by Level of Educational Attainment, Population Aged 20-25

Country	Less than Upper Secondary Education		Completed Upper Secondary Education		Completed Tertiary Education	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Australia	262.3	3.3	291.3	2.2	312.6	4.9
Belgium	259.9	13.4	295.8	5.9	319.3	5.0
Canada	231.3	36.1	293.5	11.9	309.9	6.4
Chile	206.4	5.3	248.6	3.5	276.8	4.0
Czech Republic	267.5	4.3	294.2	2.3	325.2	6.7
Denmark	257.5	4.4	295.5	1.8	303.9	4.3

7. The Living Standards Measurement Survey provides four possible levels of literacy skills: level 0 (no competence demonstrated), level 1 (rudimentary ability), level 2 (minimal competence), and level 3 (complete fundamental competence).

Finland	280.2	9.6	321.6	3.1	336.0	5.1
Germany	269.5	7.7	298.8	6.5	328.9	12.9
Hungary	216.4	6.5	265.6	3.1	287.0	9.0
Ireland	236.1	6.8	287.1	3.7	306.2	5.6
Netherlands	266.1	5.3	305.5	3.6	321.8	6.3
New Zealand	242.2	10.4	289.7	4.2	313.1	5.6
Norway	265.7	8.7	298.1	3.9	326.9	3.5
Poland	227.1	4.9	270.0	4.2	291.5	5.7
Portugal	237.9	4.6	302.0	3.0	315.0	6.3
Slovenia	202.9	7.8	272.9	3.9	300.2	7.4
Sweden	282.9	15.2	311.3	2.6	341.0	5.7
Switzerland	263.3	8.0	288.6	3.4	300.0	6.1
United Kingdom	261.0	5.5	290.6	6.5	304.7	7.6
United States	227.7	4.0	270.2	2.0	313.4	2.3

1. Combined estimate for whole country population, 1994 and 1998.

2. Values for the United States youth population are derived from the U.S. National Adult Literacy Survey (1992) because a sampling anomaly involving college students limits the comparability of the IALS data for this cohort.

Note: Belgium, Finland, Germany, and Switzerland are excluded from Figure 3.1, a-c, because the data are unreliable.

Sources: International Adult Literacy Survey, 1994-98; U.S. National Adult Literacy Survey, 1992. Cited in OECD (2000), Table 3.1.

**Table 2.** Quantitative Literacy Scores by Level of Educational Attainment, Population Aged 20-25

Country	Less than Upper Secondary Education		Completed Upper Secondary Education		Completed Tertiary Education	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Australia	259.1	3.2	291.4	2.4	308.5	4.3
Belgium	277.1	15.1	304.4	6.3	331.5	5.7
Canada	226.6	35.7	286.3	14.9	310.9	7.8
Chile	189.9	8.0	235.1	6.9	275.9	4.6
Czech Republic	289.2	6.1	320.2	3.5	354.0	9.3
Denmark	272.5	5.5	317.3	2.5	321.4	6.5
Finland	272.9	9.3	308.4	3.1	323.0	7.6
Germany	282.4	4.7	313.2	6.3	344.3	15.0
Hungary	222.0	8.6	291.3	3.5	324.7	10.9
Ireland	233.0	6.2	283.6	4.1	302.8	6.8
Netherlands	266.9	5.8	306.4	3.9	322.0	5.6
New Zealand	236.2	11.4	286.8	3.6	302.5	5.3
Norway	264.7	9.0	298.7	4.5	331.3	5.5
Poland	224.0	5.6	276.4	4.4	289.5	6.6
Portugal	244.2	6.4	294.5	2.9	305.3	6.6
Slovenia	217.8	9.4	286.0	3.6	324.0	8.5
Sweden	288.8	11.8	309.3	2.9	332.6	6.0

Switzerland	274.4	8.7	300.2	3.4	307.5	6.7
United Kingdom	251.4	6.3	285.8	6.8	300.7	7.0
United States	221.9	4.1	270.1	2.2	310.0	2.4

Sources: International Adult Literacy Survey, 1994-98; U.S. National Adult Literacy Survey, 1992. Cited in OECD (2000), Table 3.1.

Recent comparative studies (OECD & Statistics Canada, 1997, 2000), using the IALS data found a strong relationship between schooling and literacy skills after controlling for other potential factors (e.g., father’s education, mother’s education, occupation, reading and voluntary community activities, labor force participation, adult educational training, born in native speaking country, industry sector, gender, region, and age). This study showed that schooling is the most important factor in all of the IALS countries except Australia, Germany, and Switzerland (see Table 3). Formal schooling is the key determinant of literacy proficiency. For 17 out of 20 countries, it is the strongest predictor. On average, each additional year of school attended increases by about 10 pointes in prose literacy.

Although literacy is strongly related to formal schooling, it appears to be significant between literacy skills and other factors. For instance, literacy proficiency is related to the use of a language other than that used for testing. The impact of the language factor is especially large for English-speaking countries. This is also true for smaller European countries with two or more official languages. Table 3 shows that nonnative language status in Australia and Switzerland is the most important determinant of literacy skills. Both age and occupation are also major determinants in Denmark, Norway, and Netherlands. Labor force participation shows significant associations with literacy proficiency in most countries. In Germany, the effect of occupation category is larger than that of education.

**Table 3.** Standardized Regression Results of Major Factors on Literacy Skills

Variables	Australia	Belgium	Canada	Chile	Czech	Denmark	Finland
Gender	0.017	0.042	-0.005	0.035	0.037	0.108	0.007
Age	-0.133	-0.15	-0.083	-0.012	-0.083	-0.238	-0.18
Native	0.299	0.151	0.179	0.072	0.014	0.047	0.113
Parents' education	0.052	0.037	0.057	0.097	0.073	0.082	0.159
<b>Education</b>	<b>0.294</b>	<b>0.377</b>	<b>0.465</b>	<b>0.57</b>	<b>0.422</b>	<b>0.325</b>	<b>0.318</b>
Labor participation	0.112	0.072	0.064	0.011	0.023	0.043	0.103
Industrial sector	0.033	0.035	-0.042	0.058	-0.069	-0.038	0.019
Occupation	0.164	0.062	0.145	0.011	0.012	0.175	0.138
Reading at work	0.033	0.078	0.026	0.083	-0.025	0.022	-0.04
Adult education	0.09	0.048	0.071	0.004	0.051	0.063	0.091
Reading at home	0.093	0.133	0.068	0.016	0.018	0.051	0.019
Voluntary activities	0.083	0.049	0.089	0.057	0.091	0.074	0.038

R <sup>2</sup>	0.488	0.432	0.577	0.545	0.282	0.406	0.454
Root Mean Square Residual	0.014	0.013	0.015	0.012	0.015	0.023	0.020
Goodness of Fix Index	0.965	0.977	0.972	0.973	0.983	0.956	0.967
<b>Variables</b>	<b>Germany</b>	<b>Hungary</b>	<b>Ireland</b>	<b>Netherlands</b>	<b>New Zealand</b>	<b>Norway</b>	<b>Poland</b>
Gender	0.086	-0.04	0.04	0.028	0.049	0.051	0.13
Age	-0.166	-0.11	-0.044	-0.163	-0.063	-0.2	-0.16
Native	0.095	-0.01	-0.022	0.098	0.237	0.144	-0
Parents' education	0.044	0.073	0	0.081	0.066	0.07	0.03
<b>Education</b>	<b>0.181</b>	<b>0.433</b>	<b>0.485</b>	<b>0.349</b>	<b>0.34</b>	<b>0.329</b>	<b>0.388</b>
Labor participation	0.086	0.08	0.102	0.112	0.112	0.082	0.042
Industrial sector	0.016	-0.06	-0.046	0.027	0.058	-0.007	0.044
Occupation	0.201	0.02	0.071	0.11	0.141	0.139	0.091
Reading at work	0.018	-0.01	0.069	0.047	0.06	0.021	-0.02
Adult education	0.077	0.048	0.054	0.058	0.077	0.065	-0.01
Reading at home	-0.018	-0.04	0.062	0.069	0.055	0.066	-0.01
Voluntary activities	0.03	0.072	0.095	0.039	-0.002	0.094	0.115
R <sup>2</sup>	0.248	0.352	0.441	0.402	0.388	0.392	0.368
Root Mean Square Residual	0.018	0.014	0.017	0.020	0.018	0.018	0.015
Goodness of Fix Index	0.975	0.980	0.965	0.959	0.960	0.966	0.978
<b>Variables</b>	<b>Portugal</b>	<b>Slovenia</b>	<b>Sweden</b>	<b>Switzerland</b>	<b>U.K.</b>	<b>U.S.</b>	
Gender	0.153	0.009	0.11	-0.033	0.08	-0.012	
Age	0.012	-0.18	-0.123	-0.069	-0.064	0.001	
Native	0.083	0.047	0.18	0.232	0.18	0.252	
Parents' education	0.059	0.087	0.151	0.162	0.094	0.08	
<b>Education</b>	<b>0.797</b>	<b>0.395</b>	<b>0.24</b>	<b>0.195</b>	<b>0.29</b>	<b>0.389</b>	
Labor participation	-0.015	0.08	0.048	0.139	0.132	0.095	
Industrial sector	-0.09	0.069	-0.031	0.022	-0.013	-0.036	
Occupation	0.029	0.075	0.112	0.172	0.179	0.132	
Reading at work	-0.024	0.044	0.03	0.07	-0.017	0.046	
Adult education	-0.018	0.044	0.045	0.06	0.105	0.065	
Reading at home	0.049	0.017	0.033	0.102	0.082	0.079	
Voluntary activities	-0.042	0.047	0.03	0.032	0.114	-0.013	
R <sup>2</sup>	0.633	0.514	0.299	0.409	0.431	0.505	
Root Mean Square Residual	0.016	0.011	0.022	0.012	0.015	0.013	
Goodness of Fix Index	0.942	0.976	0.972	0.980	0.963	0.976	

Source: Cited from OECD and Statistics Canada (2000), Table 3.21.

Data obtained from International Adult Literacy Survey, 1994-1998. R<sup>2</sup>= Percent of variance in literacy skills accounted for by 12 predictor variables.

## **CONCLUSIONS: POLICY IMPLICATIONS AND FUTURE RESEARCH**

Literacy skills are fundamental not only to democracy but also to the knowledge economy. Policy makers have been searching for ways to raise our overall level of literacy and reduce the high degree of inequality in skills. Literacy deficits involve serious socioeconomic problems for individuals, social institutions, and governments. This paper illustrates a strong relationship between schooling and literacy skills. This finding suggests the higher the level of schooling, the higher the level of literacy skills. The IALS found that those who complete secondary school score significantly higher, on average, than those who do not. Policy makers should note those early school leavers who drop out of schools before completing upper secondary to increase the average national level of literacy skills. These early leavers face two disadvantages: inadequate literacy skills and few opportunities to further education and training. Early school leaving is ineffective to improve literacy skills. Leaving school before completing upper secondary education dramatically reduces opportunities over the life course. School dropouts bring relatively little formal education to a labor market that increasingly values skills typically learned in school. Dropouts tend to receive little training, either from their employers or from private programs, and as a result have few opportunities to acquire job-specific skills.

There are still further issues of schooling effects in literacy production function. Recent studies have neglected two potential problems in literacy production function: the nonlinear effects of schooling and the endogeneity of schooling. A more rigorous research design is required to examine these issues.

First, recent studies (Charette & Meng, 1998; OECD & Statistics Canada, 2000) have simply assumed a linear relationship between schooling and literacy skills, implying constant marginal effects of schooling on literacy skills. However, the relationship between schooling and literacy skills is not necessarily linear. For instance, the diminishing returns to schooling are well documented in most educational production functions. In addition, there might be some threshold at which increases in schooling have a dramatic effect on literacy skills. A year of schooling can also be weighted differently depending on the quality of the education system in which it takes place. Furthermore, the effects of schooling may interact with family backgrounds and cohort differences. Though there is a widespread agreement that additional schooling is positively associated with literacy skills, the linearity assumption has not been rigorously tested. We need to examine potential nonlinear relationships between schooling and literacy skills. There might be potential nonlinear relationships between schooling and literacy skills, including diminishing returns to schooling, ineffective years of

schooling, diploma effects, and interactions with parental education and age cohorts.

Second, research has long recognized that the effects of schooling with cross-sectional data are likely to differ from the true causal effect. More specifically, the cross-sectional data make it difficult to isolate a set of variables that influence both schooling and literacy skills simultaneously. Failure to account for the effect of the unobserved factors on both schooling and literacy skills would lead to incorrect inferences regarding the causal effect of schooling. Econometric studies refer to this as the problem of omitted variable bias (Griliches, 1977). Other methodological studies refer to it as a threat to the internal validity arising from the interaction of selection and maturation (Cook & Campbell, 1979). Standard ordinary least squares estimates of the effects of schooling based on cross-sectional literacy data are likely to be biased because of a failure to account for potential correlation between schooling and the unobserved ability factors. To deal with the endogeneity of schooling, research has used proxy variables for ability, instrumental variables using two-stage least squares, and fixed-effect techniques to identify the causal effects of schooling. However, recent studies (Kirsch, Jungeblut, & Kolstad, 1993; OECD & Statistics Canada, 1997, 2000) have not seriously examined the endogeneity of schooling in literacy production functions. The existing literature using recent literacy surveys has not controlled for endogenous schooling choices and unobserved factors in the analysis of the effect of schooling. As a consequence, schooling estimates obtained from recent literacy studies are likely to be inconsistent due to uncontrolled preexisting difference. The schooling effects in literacy production function might be biased because of omitted variables such as unobserved ability factors and differences in human capital investment.

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