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ABSTRACT

A literature review was conducted to determine the nature and extent of the transfer of literacy learned in one situation to other situations and to identify ways of facilitating literacy transfer. The literature review focused on studies and analyses dealing with three areas: the definition and scope of intelligence, differences between experts and novices, and transfer theory development. Literacy ability was found to transfer to a very limited degree. The basic, automatic, and internalized aspects of reading, including moving eyes over a page and recognizing letter-sound relationships and very basic vocabulary, are most easily transferred. Transfer of mindful strategies (for example, summarizing, problem solving, studying, writing for multiple audiences, and editing) did not appear as automatic as transfer of the internalized aspects of reading did. Transfer of mindful strategies was, however, possible in cases involving transfer to tasks very similar to the original task mastered. In view of the limited nature of literacy transfer, it was recommended that educators place additional emphasis on the degree to which education helps learners change their literacy perceptions and lifestyles along with their current skills. (Contains 67 references.) (MN)

NATIONAL CENTER ON ADULT LITERACY

LITERACY TRANSFER:

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A REVIEW OF THE LITERATURE

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Abstract

A tacit assumption of much literacy learning is that literacy learned in one situation will transfer to most other situations. This report addresses the following three questions: What is the nature of transfer? To what extent does literacy transfer exist? and How can literacy transfer best be facilitated? Literacy ability does transfer to a very limited degree, which is probably attributable to the basic, automatic, internalized aspects of reading (i.e., how to move eyes over a page, recognizing letter/sound relationships, recognizing very basic vocabulary). Learning to transfer mindful strategies (i.e., summarizing, problem solving, studying, writing for multiple audiences, editing, etc.) does not appear to transfer as automatically, but is possible—at least to tasks that highly resemble the original learning task. The limited nature of literacy transfer suggests that educators should place even more emphasis on the degree to which education helps learners change their literacy perceptions and life-styles along with their current skills.

INTRODUCTION

Effective learning involves much more than acquiring knowledge. Learners must be able to organize, manipulate, and use or transfer initial learning to new situations. A tacit assumption of much literacy learning is that literacy learned in one situation will transfer to most other situations.

Research and theorizing on what constitutes transfer have occurred in many fields. Two definitions of transfer that are particularly useful for the field of literacy study come from Perkins and Salomon (1989) and Bigge and Shermis (1992). Perkins and Salomon (1989) define transfer as the ability to apply knowledge, skill, and specific strategies from one domain to other novel situations. Bigge and Shermis (1992, p. 218) suggest that "transfer of learning occurs when a person's learning in one situation influences that person's learning and performance in other situations." These two definitions of transfer will serve as guidelines for discussion in this monograph.

Definitions of literacy are many and sometimes situational. They range from attempts to describe the complex interactions between reading and writing to more encompassing descriptions of written language usage embedded in cognitive, metacognitive, and social communication theories. In the workplace, comprehension and use of graphic, tabular, and quantitative displays also enter into the discussion. For the purposes of this report, we maintain that literacy is both a process of developing and learning a range of specific uses of print and other information displays and a collection of life-long habits and processes that enable one, through practice and reflection, to further develop, improve, and expand the literacy abilities one already has. Langer's (1987) concept of learners assuming "ownership for their literacy activities" is central to this later notion. In examining the relationship of literacy and transfer, this report discusses a wide range of literacy studies which address the mastery of specific literacy abilities as well as the increased ownership and control of broader literate strategies, practices, and behaviors.

A key issue for workplace literacy training is the degree to which literacy learned in workplace programs transfers to new situations on the job and in other segments of the learner's life. Typical workplace literacy programs provide less than 50 hours of instruction a year; only a rare few provide as many as 100 hours of instruction per year. There is little opportunity for instructors to provide extensive experience in a broad array of literacy tasks. If newly learned improvements in reading and writing automatically transfer to most new situations a learner encounters, then instructors and program planners need not be overly concerned about the nature of curricula and what sorts of materials are used with learners. If, on the other hand, transfer is often absent or severely limited, then what is covered during instruction must be carefully considered so that it may be of later use to learners.

For the last decade, discussion of the topic of literacy transfer to the workplace has occurred from two potentially contradictory viewpoints. At a very basic level, it seems reasonable to assume that mastery of certain aspects of reading and writing (i.e., the alphabet, key vocabulary, word order) is likely to transfer from one literacy task to most others. These basic aspects of literacy seem a foundation for accomplishing nearly any literacy task one can

imagine. In addition to these basic aspects of literacy, some have suggested that a good deal more literacy transfers from one situation to others within the workplace. In the early '80s, Greenan (1982) postulated a list of transferable, generic, workplace literacy skills based upon surveys of vocational education instructors who named comparable skills across several different occupation categories. This trend of looking for similarities among tasks and occupations has continued into the late '80s and early 90s. Brizius and Foster (1987) postulate the existence of "portable skills" that might be carried from job to job, and the U.S. Department of Labor's (1991) SCANS commission suggests that most jobs require mastery of five basic skill areas (most of which involve literacy). The assumption is that mastery of the general skill areas will transfer to most new jobs.

At the same time that these discussions about generic or portable skills were taking place, a growing body of research began to suggest that literacy transfer may be quite limited and that one must master literacies rather than literacy. Literacy skills that seem similar to an outside observer who has already mastered them, may not appear so similar to a new learner. Proponents of this view cite evidence indicating that seeing connections and being able to apply freshly learned strategies to new situations may not occur often and easily for most learners. As one moves into the wide array of literacy challenges facing adults, the problem of transfer becomes even more complex. Duffy (1985) points out the different information-processing demands of reading various types of text (i.e., newspaper, job manual, computer screen, poem, weather graphic). Sticht (1982) found that enlisted men who improved in general literacy classes were not able to perform particularly well on job-reading tasks, although enlisted men who learned with job-related materials did show improvement on job-reading tasks. The National Assessment of Educational Progress survey of Young Adult Literacy (Kirsch & Jungeblut, 1986) found only about 25% shared variance or overlap among performances on the test's three scales (Prose Reading, Document Reading, and Quantitative Reading).

It seems likely that there is some degree of literacy learning transfer as one moves from literacy task to literacy task. It also seems likely that the degree of transfer is less than many have thought. Policy planners and developers of workplace literacy programs need a clearer understanding of literacy transfer in order make program choices about literacy transfer in specific situations. When, if ever, are general literacy programs best? When, if ever, are programs using custom-designed materials and tasks from a particular workplace best?

This report will address the question of literacy transfer by first examining what research has revealed about transfer in general, then specifically examining studies that focus upon literacy transfer, and finally discussing instructional approaches that evidence suggests will facilitate literacy transfer among adults in workplace and other settings. Three key questions will guide the discussion:

- What is the nature of transfer?
- To what extent does literacy transfer exist?
- How can literacy transfer best be facilitated?

WHAT IS THE NATURE OF TRANSFER?

The nature of transfer has interested psychologists and educators for more than a century. Useful studies and analyses have appeared in three major areas: (a) intelligence definition and scope, (b) expert-novice differences, and (c) transfer theory development.

INTELLIGENCE-DEFINITION AND SCOPE

In the process of defining intelligence, psychologists noticed a tendency for some people to be better able to learn and to relate information from one area to another. They labeled this ability as the "g" or general intelligence factor. They posited that this factor was related to ability to learn and to move from one cognitive situation to another. Success in new situations related not so much to transfer of knowledge, but to transfer of the ability to learn quickly. This factor was often believed to be inherited and therefore fixed and immutable.

The validity of both the "g" concept and the immutability of intelligence has been challenged. One of the earliest challenges came from Franz Gall in the nineteenth century. Gall posited that different forms of perception (music, memory, etc.) exist and that people have differing strengths in each form of perception (Gardner, 1983, p. 12). Throughout the twentieth century, Piaget, Vygotsky, and a host of other psychologists offered evidence of intellectual growth occurring as a result of interaction between society and the individual. If there is a general intelligence, it may well be influenced by sociocultural factors and not be truly inherent.

Although general intelligence is no longer acknowledged as the universal explanation for cognitive ability, it still has some defenders. Jensen (1985), in analyzing 20 of compensatory programs data (Headstart and others), notes that these programs do succeed in socializing children and help them remain in school and often improve their grades. The evidence suggests that such programs do not, however, improve children's relative performance on IQ tests or any other test of cognitive ability (i.e., standardized reading and mathematics tests). Jensen attributes this to information-processing deficits that are part of a fairly stable "g" factor. Hunter and Hunter (1984), in a meta-analytic synthesis of adult job-performance data, note that measures of general cognitive ability are better predictors of future job performance than every other indicator except performance on similar job tasks. This, too, may support arguments for some form of general intelligence that undergirds individual differences in ability to learn new tasks.

Most recent psychological research has moved away from single measure indicators of intelligence. As an alternative to using end product test results as measures of intelligence, a good deal of recent psychological research has examined how the mind processes information. These studies have led to several concepts that have a direct bearing on the nature of transfer. Gardner (1983, p. 60) suggests that intelligence "must entail a set of skills of problem solving . . . and must also entail the potential for finding or creating problems—thereby laying the groundwork for the acquisition of new knowledge." Gardner identifies several naturalistic areas of human reasoning

that might legitimately be termed intelligences (i.e., language, musical thinking, logical-mathematical analysis, spatial representation, bodily-kinesthetic understanding, and personal). Sternberg (1988) finds intelligence to be represented best by a triarchic combination of processes. Sternberg combines analytical, synthetic, and adaptive factors in defining intelligence.

As one element of his definition, Sternberg discusses the degree to which the individual can focus attention and use strategies to monitor, analyze, and use reason in any given situation. Experience may have a great deal to do with intelligence and the ability to transfer learning from situation to situation. Motivation and will also have a great deal to do with working intelligence and transfer. When we examine the literature on transfer, it becomes clear that psychologists are looking at multiple areas of intelligence to see what transfers (skill, knowledge, or adaptability) from one situation to others.

To summarize, although there is some indication that general intelligence is related to transfer, much recent work suggests that the concept of a single general intelligence is misleading. There may be multiple aspects of intelligence, and intelligence is highly likely to be influenced by experience. This implies the need to much more clearly define what is being learned and link instruction with what the learner will be expected to do with new learning.

EXPERT-NOVICE DIFFERENCE

The nature of expertise has been studied in various fields from chess, physics, and mathematics to athletics and music. In the 1970s, it was thought that experts were primarily different from novices in that they used more sophisticated strategies for thinking and problem solving (Sweller, 1990). Subsequent reasoning suggested that if one could teach those strategies to a novice, he or she could transfer them and become more expertlike. Careful research has shown the differences between novice and expert to be more complex.

Experts know a good deal. They have highly organized and extensive knowledge bases in the domains for which they are expert (Chi, Feltovich, & Glaser, 1981). Researchers have also found that the experts' more thorough understanding of their expert area allows them to "chunk" large pieces of information into meaningful patterns (Chase & Simon, 1973; Chi et al., 1981; Schoenfeld & Hermann, 1982). With this vast amount of interconnected knowledge, experts use more sophisticated thinking and problem-solving strategies. They formulate multiple and flexible alternate theories about what they see (Dawson & Zeitz, 1989), and reflect on problems by using past knowledge and by monitoring current application in order to move them to the best acceptable solution (Chi et al., 1981).

Moving from novice to expert involves two basic premises: acquiring more knowledge and knowing what to do with that knowledge. Experts' inherent curiosity propels them to continually nurture their knowledge bases with practice and extensive experimentation. This regular and extensive practice enables them to retrieve information spontaneously and make valuable connections to past knowledge quickly. Novices, on the other hand, rely primarily on surface features and explicit details to understand problems (Schoenfeld & Hermann, 1982). The goal of the novice is often to move

toward an immediate solution, whereas the goal of an expert is to thoroughly understand the problem before contemplating solutions (Chi et al., 1981).

The study of expert-novice differences, seen in the light of what we know about intelligence, indicates that transfer does not come easily. One must diligently work to develop a large knowledge base, practice to make links between ideas within that knowledge base, and master metacognitive strategies to monitor learning. Berryman and Bailey (1992) cite a growing body of research often labeled *situated cognition*, which indicates that learning transfers best when it is done in real situations in which both knowledge and strategies are learned at the same time. When electronic technicians receive extensive classroom training in electronics and the theory of trouble-shooting, they are not able to transfer the knowledge to improved trouble-shooting on the job (Morris & Rouse, 1985). Expert carpet layers who can do flawless arithmetic on the job, fail arithmetic tests that decontextualize learning (Scribner & Fahrmeir, 1982). They are able to transfer their skills to the situations in which they learned them, but not much further. Learning strategies and knowledge at the same time in realistic situations appears to be key to successful transfer.

TRANSFER THEORY DEVELOPMENT

Theories of learning transfer, both informal and formal, have abounded for centuries. This discussion will provide a brief historical overview of the extensive development of theoretical frameworks that have appeared in the research literature.

DOCTRINE OF FORMAL DISCIPLINE

The doctrine of formal discipline, dating back to Plato, suggests that by teaching some specific form of knowledge and the discipline involved with learning it (i.e., Latin, computer programming, or mathematics), most learners automatically strengthen certain other abilities such as memory or logic. Recently, the academic discussion of this notion has revolved around the claim that learning the computer language of Logo would bring about improvement in problem-solving skills (Au & Leung, 1991; Grandgenett & Thompson, 1991). Earlier discussions have suggested that learning Latin would bring about improved mastery of English (Lederer, Orlando, & Cevoli 1983). Although an individual will occasionally report making links between learning in one area and learning in other areas, large group studies have detected no evidence for general transfer for the majority of learners. Syntheses of over 100 transfer studies find no substantiation for this theory of transferring logic or problem solving or any other benefit after learning a target subject (De Corte & Verschaffel, 1986; Salomon & Perkins, 1987a, 1987b). Although this notion of formal discipline or extra benefit has been largely discredited by research, it continues to reappear in many general discussions of transfer as if it were a proven theory.

THEORIES OF IDENTICAL ELEMENTS AND GENERAL PRINCIPLES, AND INTERFERENCE

An alternative theory of transfer, which postulated that transfer would occur in the presence of shared elements, became important in the early history of experimental psychology. One of Thorndike and Woodworth's (1901) widely recognized studies investigated the transfer of perceiving words with certain letters rapidly and accurately to the accurate and rapid

perception of new words containing different letters. It was reasoned, and partially documented, that the degree to which both tasks shared identical features determined positive transfer on the part of the learner. A related but competing theory (Judd, 1908) posited that understanding a general principle (rather than a distinct element) would transfer to several situations. Learning the principle of light refraction in water in one case or situation was shown to transfer to new cases and situations. Studies of transfer throughout the first half of this century occurred both in the laboratory and in classrooms. Variations of identical elements studies occurred in laboratories using a multitude of techniques and instruments from stop watches to tachistascopes to measures of galvanic skin response. During the same time period, several broad (and untestable) theoretical formulations were proposed to account for transfer (or more often lack of transfer) in classrooms. In 1949, Osgood reviewed a half-century of transfer research and expressed his frustration at the vagaries of inconsistent measurement, the lack of specification for what should be measured, and at the sometimes atheortical nature of research. He complained:

> There are no clear-cut generalizations which satisfactorily bind the data together. The difficulty may be traced, in part, to the bewildering variety of procedures, materials, and experimental designs employed by different investigators ...But some of the confusion can also be laid to the fact that in a large proportion of experiments the theoretically relevant relations are patently unspecifiable. (p. 132)

Cormier and Hagman (1987), in commenting upon this period, note that the conceptual understanding of transfer did not advance as fast as empirical findings accumulated. Some researchers were finding examples of negative transfer and of interference. The terms *proactive* and *retroactive inhibition* entered transfer discussions as attempts to explain how forgetting, learning, and transfer difficulties can result from interference between new and older learnings. Other researchers presented the results of experiments of *stimulus predifferentiation*, which documented the need to become generally acquainted with the learning environment before the learner could even notice the subtlety of some new transfer situations. The examination of interference in relation to learning and transfer characterized much of the research throughout the 1950s and early 1960s.

During the 1960s and 1970s, transfer research declined within the framework of interference theory as attention shifted to more cognitive-based accounts of learning. Given the expansion beyond a single methodological approach, the discussion of transfer became more diffused and subsumed within the context of other issues. In many studies, examination of transfer was only a secondary or a tertiary goal. In such studies, attention to specifying degree of transfer and how to measure transfer was often lax and results related to transfer were relegated to a few paragraphs in discussion sections of articles.

NEAR AND FAR TRANSFER, VERTICAL AND HORIZONTAL TRANSFER

From the early 1900s to the 1970s, the study of transfer became increasingly more complex. Researchers (primarily in psychology) continued to perform transfer research using modifications of Thorndike's identical elements theory. In an attempt to differentiate the degree to which identical elements were shared, terms like *near transfer* and *far transfer* evolved. Gagne (1965) expanded the near/far concept with the terms *vertical transfer* and *horizontal transfer*. Vertical transfer referred to increased complexity within very similar tasks and horizontal transfer to increased complexity within increasingly dissimilar tasks. Near and far were relevant on both continua. These terms also provided a conceptual framework for differentiating between *learning* and *transfer*. Learning referred to mastering a task in the exact context in which it was taught, whereas transfer referred to the ability to successfully apply learned abilities to new tasks which shared several, but not all (near transfer) or few (far transfer) central elements with the learning task.

Carefully controlled laboratory studies attempted to specify and operationalize these terms by specifying transfer in terms of slight variations in simple tasks (associating sound tones with other stimuli, rapid perception of relationships, etc.). Difficulties arose, however, when other researchers attempted to extend the theoretical structures to more complex problem-solving and educational tasks (Mayer, 1975; Royer, 1979). The problems of clearly specifying which elements in tasks are identical, whether the specified elements are central, and whether the same elements are central for different learners clouded study results. Other difficulties revolved around how to specify near and far in a way that allowed one to draw conclusions across studies. Further, if distance needs to be considered in both vertical and horizontal terms, the concepts of near and far become even more difficult to specify. Much research in this area has been equivocal, inconsistent, and does not allow for generalization across studies. Cormier and Hagman (1987), in reviewing transfer research to the mid-1980s, state:

> In our view, there are four generic issues important to a comprehensive description of transfer, both as a learning phenomenon and as an event with substantial importance to real-life situations. These issues are: (a) how transfer should be measured, (b) how training for transfer differs from training for rapid acquistion, (c) how direction and magnitude of transfer are determined, and (d) whether different principles of transfer apply to motor, cognitive, and metacognitive elements. (p. 1)

HIGH AND LOW ROAD TRANSFER

In the late 1980s, a new theoretical framework began to emerge as a way to describe transfer productively and account for the sometimes conflicting results of previous studies. Salomon (working with Globerson and Perkins), in a series of analytic syntheses of transfer research in the 1970s and 1980s, has attempted to organize, categorize, and theorize from the evidence available for transfer. After reviewing two decades of transfer studies, Perkins and Salomon (1989, p.19) observe that:

> To the extent that transfer does take place, it is highly specific and must be cued, primed, and guided; it seldom occurs spontaneously. The case for generalizable, context-independent skills and strategies that can be trained in one context and transferred to other domains has proven to be more a matter of wishful thinking than hard empirical evidence.

Salomon and colleagues have constructed a theory of transfer which can explain why in some studies transfer seems to be verified and in others it is not. They suggest that transfer is actually a multifaceted phenomenon rather than a singular one. Some skills, like driving a stick shift car, become automatic through intense practice without mindful attention. Such skills can easily transfer from driving a car to driving a truck. Comparable intensive practice of literacy skills would be tracking print lines on a page or recognizing very familiar vocabulary. This sort of automatic ability is termed *low road transfer*. Intense, long-term practice is key to such transfer and little or no conscious thought is involved. Not all transfer is of this automatic sort, however.

Some transfer requires the mindful application of abstract concepts to new situations. For example, time-management strategies learned in junior high school might be drawn upon to solve new problems in college. Delay strategies taught to a child unable to control his temper can be mindfully recalled to help an adult dieter delay and overcome impulsive food purchases. Comparable literacy strategies would be consciously applying a previously learned note-taking technique to a new situation or a trained reader of philosophical writings consciously looking for counter-examples when reading the political claims of candidates. These strategies are termed *high road transfer* (Perkins & Salomon, 1989; Salomon & Globerson, 1987). Although for some experts, these strategies can become nearly automatic, they are usually mindfully chosen and applied. In the field of literacy study, many of the strategies described as metacognitive (i.e., setting goals, asking questions, making predictions, summarizing ideas) would qualify as examples of high road transfer in Salomon's framework.

TO WHAT EXTENT DOES LITERACY TRANSFER EXIST?

Very few studies have directly addressed the question of literacy transfer. Almost none of them directly address a theoretical framework related to transfer or specify degree of transfer clearly. In some cases, this makes it problematical to compare the results of various studies. What some researchers label as transfer to new situations might be argued to be simple learning by other researchers because assessment tasks do not differ enough or in a measurable way from instructional tasks. Most of the information available comes from studies primarily designed to address research goals other than transfer. A number of studies have addressed core psychological abilities associated with beginning literacy. This core of abilities can be construed to be central to all literacy, and therefore, possibly transferable. Other, more anthropological studies have examined what aspects of literacy

which are present in one context are present or missing in other contexts. Some psychometric analyses of literacy test performance attempt to define statistically the extent or limits of transfer. Finally, studies of literacy performance on school tasks and workplace literacy tasks have attempted to define the degree of transfer from school literacy to workplace literacy.

CROSS-NATIONAL AND ANTHROPOLOGICAL STUDIES OF LITERACY

In his historical examination of literacy definitions, Venezky (1990, pp. 10-11) notes that:

> Cross-national studies of reading process suggest that a common core of psychological abilities may exist for reading and, in particular, for reading alphabetic and syllabic writing systems. These processes involve primarily the coordination of eye movements into fixations and subsequent saccadic jumps, the acquisition and utilization of symbol-sound correspondences, the building of rapid identification of word units through the integration of information from a variety of sources, and the use of local and global processes to obtain meaning.

Nearly all of the above processes are developed through intensive practice, become automatic as opposed to mindful, and are usually mastered by U.S. children with four to five years of schooling. In Salomon's theoretical framework for explaining learning transfer, these processes would constitute low road transfer of basic literacy processes.

Evidence for transfer beyond this most basic literacy level becomes more problematic. Scribner and Cole (1978) studied literacy among the Vai in Africa. The Vai culture has a variety of different types of literacy—one used for schooling, one for commerce, and one for social purposes. In the Vai culture, it is possible to examine literacy in conjunction with schooling as well as separate from schooling since many people learn only a single literacy. Scribner and Cole concluded that many of the cognitive abilities often associated with literacy (i.e., using abstractions, drawing conclusions based on logic, etc.) were more accurately associated with schooling. These cognitive abilities were not associated with all forms of literacy— only the form of literacy learned in schools. People who were proficient only in the literacy of commerce or the literacy of letter writing did not automatically develop abstract cognitive abilities. To develop these cognitive skills, one needed to learn a particular type of literacy. In fact, Scribner and Cole (1978) concluded that "the effects of literacy and perhaps of schooling as well are restricted...generalizable to only closely related practices" (p. 457).

PSYCHOMETRIC ANALYSES OF LITERACY ABILITIES

For nearly seven decades, literacy researchers have noted that there is some connection—but very little—between learner scores on tests measuring different sorts of literacy abilities. Ritter and Lofland (1924) and Salisbury (1934) found very low correlations between general reading ability, as measured by standardized tests, and ability to read and reason. In 1944, Artley tested 242 eleventh-grade students with six different general reading,

social studies reading, and nonverbal intelligence tests. Artley found correlations among subtests to vary widely, with most correlations being in the r = .3 to r = .5 range (i.e., 9% to 25% shared variance or overlap). He concluded that "every classroom teacher has the direct responsibility for developing those reading skills and abilities essential for adequate comprehension within his particular area of instruction." This research finding, and others like it, fueled the move to legislatively mandate content area reading courses for high school content area teachers. The general finding of only moderate correlations among an individual's scores on tests for reading different types of materials is echoed by comparable correlations (r = .4 to r = .5) among Prose, Document, and Quantitative Reading scores on the National Assessment for Educational Progress Test of young adult readers (Kirsch & Jungeblut, 1986). Reder's (1994) analysis of correlations among Prose, Document, and Quantitative Reading scores on the National Adult Literacy survey data gathered in 1992 reveals higher intercorrelations among test scales. Explanations for differences between 1986 and 1992 data are not yet available.

Carroll (1981), in his invited remarks to the International Reading Association, observed that drawing conclusions about transfer, even from relatively high correlations, is somewhat suspect. Good students are absent from school less frequently than poor students, and they are likely to encounter a wider variety of reading materials in the home. As a result, good students may improve in several different skill areas at the same time while poor students, who practice little, do not improve much at all. This situation would produce moderately high correlations among test scores, thereby inflating the degree of transfer one might suppose exists between one type of reading and others. Good students practice nearly everything and improve in nearly everything. This does not indicate that there is a transfer between performance in one area and performance in others. In other words, instruction that leads to improvement in one area is not necessarily likely to lead to improvements in correlate areas. The actual amount of real transfer is likely to be much lower than what 16%-25% shared variance would suggest.

GENERAL LITERACY, WORKPLACE LITERACY, AND JOB PERFORMANCE

Determining the extent to which general literacy can transfer to performance in the workplace is a difficult task. The U.S. Department of Defense (1984), in comparing job performance to performance on the ASVAB test (essentially a multiple-choice standardized test that correlates extremely highly with other standardized reading tests), notes the following correlation ranges: (a) .36 to .52 for jobs in communications, (b) .39 to .77 for jobs in data processing, and (c) .53 to .73 for clerical and supply specialties. This suggests that scores on a test that is essentially a vocational literacy test can predict anywhere from 13% to 60% of the variance for job performance, depending upon the job.

Hunter and Hunter (1984) meta-analyzed the results of hundreds of studies designed to predict job performance. They found that reading tests and other cognitive measures (as limited as they are) were more effective predictors of job performance than were either perceptual or motor abilities and were more effective predictors than biographical inventories, interviews, expert recommendations, or amount of previous education. People who

scored highly on the tests tended to perform better on the job. This is strong circumstantial evidence that general literacy transfers somewhat to job performance. Carroll's criticism that the correlations may be inflated because top performers learn many things at the same time is also valid in this situation.

Mikulecky and Winchester (1983) and Mikulecky and Ehlinger (1986) interviewed, observed, and tested nurses and electronic technicians at three levels of experience (i.e., in-training, experienced, and supervisory). The researchers were attempting, in part, to determine the relationship of literacy abilities to actual job performance. In each study, there was no significant relationship between job performance and general literacy, as measured by a CLOZE test constructed from a newspaper passage. There was, however, a relationship between job performance and employees' actual daily use of metacognitive literacy practices (i.e., summarizing, making predictions based on reading, focussing by using notes or underlining, and consciously looking for applications).

Studies that approach this problem of workplace literacy transfer by studying the performances of learners before and after receiving training cause us to question the extent of transfer from general training to workplace application. Sticht (1982) reports on a study of 700 enlisted men who received either job-related literacy training or general literacy training. All learners improved while receiving 120 hours of instruction. On tests of job-related reading, however, those receiving job-related literacy training outperformed the regular literacy learners by 300%. Although there was some slight transfer to job-related reading performance from the general training, the transfer was negligible compared to the performance of learners who received specific job-literacy training. Mikulecky and Lloyd (1992) used pre- and post-interviews, supervisor ratings, and tests to assess the impact of various types of literacy training on changes in learners' literacy beliefs, practices, performances, and plans at home and on the job. Learners at two different worksites participated in one of several different types of literacy class (i.e., general literacy training, ESL literacy & communication, and workplace specific literacy & communication training). Classes were effective in that learners made gains. Gains were limited to what instruction focused upon. When instruction addressed workplace materials and tasks, there were improvements in these areas. When instruction focused upon increasing literacy practice at home, there were improvements in the amount of reading done at home. When instructors taught strategies for reading training or workplace materials, learner literacy strategies became more sophisticated and performance improved. When class discussion addressed future choices and possibilities, learners' plans for future education became more distinct and elaborate. No class addressed all the literacy goals and there was virtually no evidence of learners transferring practices and abilities beyond what had been directly addressed by instruction. Mikulecky (1992) reports that extending the workplace literacy evaluation framework to four additional worksites reinforced the conclusions derived at the initial two worksites.

To summarize, there appears to be only a limited relationship between general literacy ability and the ability to use literacy on the job. This relationship is probably only at the most basic level of literacy processes (i.e., eye movement, letter/sound relationships, word recognition). Correlations between general literacy performance and workplace performance range from

slight to moderate, but even this circumstantial evidence for transfer may be overinflated because top performers tend to learn several types of literacy at the same time. Studies that compare workplace learner performance before and after short-term instruction (i.e., 30-200 hours) demonstrate almost no literacy transfer beyond what has been directly taught.

IMPACT OF INTELLIGENCE ON TRANSFER

During the past decade, there has been a good deal of controversy about the nature of intelligence. The few studies that analyze the relationship of learning transfer to intelligence have been done with children and adolescents and have employed traditional IQ tests to assess intelligence. Findings from these studies will be considered here, but results must be viewed with a great deal of caution until further research is performed with adults to determine the relationship between measured intelligence and literacy transfer.

Campione, Brown, Ferrara, Jones, and Steinberg (1985) and Ferrara, Brown, and Campione (1986) have performed a series of experiments to more clearly delineate the relationship between transfer and intelligence. These studies focus on performances of seven-year-olds, ten-year-olds, and mentally retarded fourteen-year-olds whose IQ test performance indicates an average mental age of ten.

In the 1985 study, ten-year-olds with average intelligence were compared to mentally retarded fourteen-year-olds with a tested mental age equivalent to the normal ten-year-old. Each group was taught strategies for solving picture problems which involved adding, subtracting, or visually rotating parts of diagrams. The mentally retarded group, through intense, structured instruction (up to three days), was able to reach a level of performance equal to that of the normal ten-year-olds. Learning was possible. One day after training, both groups were given new problems to test how well they had maintained what they had learned and how well they could transfer strategies. The transfer problems were completely new problems that introduced changes to move learners progressively further away from the practice problems. Although the mentally retarded adolescents were able to maintain some of what they had learned after a day's rest, it was significantly less than the performance of normal ten-year-olds. The performance gap was even wider for transfer problems, with almost no transfer among the mentally retarded group. Campione et al. (1985, p. 313) note, "the lower the ability level of the student, the smaller the change required to generate some disruption of performance."

Ferrara et al. (1986) performed additional experiments with average and high IQ seven-year-olds and ten-year-olds. The children were asked to pretend that they were spies trying to decode messages in strings of letters. They were taught strategies for identifying patterns among letters. When six problems could be solved without assistance, training was considered complete. Two days after training, children were asked to "think out loud" as they tried to identify patterns. The children were told that hints would be given, if needed, to solve the problems, which ranged from exact problems from training (i.e., maintenance problems) to problems which became increasingly different from training (i.e., transfer problems). Results indicate that older children outperformed younger children in both maintenance and transfer tasks and that high IQ children outperformed average IQ children.

The higher the IQ, the fewer the prompts required. The gap between high IQ and average IQ in number of prompts required to solve problems increased as transfer problems increasingly differed from practice problems.

To summarize, this series of studies suggests that for children and adolescents the amount of transfer is related to measured intelligence. In addition, the more dissimilar the transfer task is from initial training, the larger role measured intelligence appears to play in independent transfer performance. The authors of all studies in this area express caution that their work not be overgeneralized, since some learners who score low on IQ measures are able to transfer what they have learned.

TRANSFER AND LEARNING DISABILITY

Discussions of transfer and learning disability are important to the discussion of adult literacy. There is some evidence that a significant number of adults who have passed through years of schooling and still read at very low levels also have significant learning disabilities. Adult literacy programs that teach for transfer need to be based, in part, on what we know about transfer and learning disability. Keefe and Meyer (1988, p. 615) tested over 100 adults in an adult literacy program. Among adults with the lowest literacy levels (i.e., third-grade level and below), the authors report that approximately 78% had tested learning and language disabilities. There are few studies of adult learning disability that determine the impact of these disabilities upon learning and transfer. The few studies that have examined the relationship of transfer to learning disability have focused upon children and adolescents.

Gelzheiser (1984) examined how well learning-disabled adolescents (compared with a nondisabled control group and a learning-disabled control group) could learn and transfer strategies for organizing and retrieving information from memory. Results indicate that the learning-disabled adolescents were able to learn and transfer the strategies that they were taught. Recall of facts by learning-disabled students who received strategy instruction was significantly better than their learning-disabled peers who did not receive this instruction. All learning-disabled groups still scored significantly lower than the nondisabled control group.

Collins, Carnine, and Gersten (1987) found that adolescent learning-disabled and remedial students trained in simple reasoning problems could transfer this training to paragraphs with embedded reasoning problems. The training was highly structured using five 20-30 minute sessions with a computer program. Those in the experimental group who gave incorrect answers were provided elaborated corrective feedback while those in the control group were simply informed when answers were wrong. Results show that students trained with elaborated corrective feedback significantly transferred their training. They were able to identify reasoning problems in embedded paragraphs at a higher level than were students in the basic correction group. Given sufficient training time, learning-disabled adolescents were able to learn and transfer logical reading strategies.

Kerchner and Kistinger (1984) studied whether fourth-, fifth-, and sixth-grade learning-disabled students could transfer their training in process writing on the computer to process writing using pencil and paper. For seven months during a portion of each day, students received literacy instruction. In

the control group, students used extensive language experience with no word processing. Reading instruction involved a variety of texts and students concentrated on developing spelling skills through teacher dictation of sentences. The experimental group used the *Bank Street Writer* word processing program. They composed at the keyboard, participated in editing conferences, edited at the keyboard, and illustrated compositions. The experimental group outperformed the control group on thematic maturity, word usage, style, and overall writing test score. There were no significant differences on vocabulary, spelling, and handwriting or reading ability. The authors conclude that when learning disabled-students are provided with extensive training, they are able to transfer writing skills from computer composition to handwritten composition.

These studies of learning-disabled children and adolescents provide evidence for the ability of disabled learners to transfer literacy training to relatively new tasks. Training time ranged from a few hours for relatively simple tasks to more than 100 hours for more complex composing tasks. In the only study comparing disabled learners to a nondisabled control group, training helped LD students to transfer learning, but performance was still significantly below a nondisabled control group which received no training.

How Can Literacy Transfer Best Be Facilitated?

As some of the studies above indicate, it is possible to teach successfully for transfer, but it takes significant, focused effort. An examination of literacy instruction studies in which transfer of learning was assessed reveals some patterns for effective transfer instruction. Again, as earlier, there are few instructional studies which address literacy transfer for low literate adults. When such studies are not available, the selection of studies reported in this section will focus upon older children, adolescent, or undergraduate readers.

Modeling, Practice, and Feedback

Several literacy studies have shown that when instruction (a) explains and models effective literacy practice, (b) provides sufficient practice time, and (c) provides substantial feedback, students are able to transfer freshly learned literacy strategies to new tasks. Several successful approaches to modeling, practice, and feedback emerge from research. Among these approaches are reciprocal teaching to demonstrate metacognitive strategies, think-alouds to demonstrate cognitive and metacognitive processes, and computer-guided instruction to model the use of concept mapping to help comprehend textbook chapters.

Palincsar and Brown (1986) report on a series of studies with children and early adolescents in which students successfully learned to transfer several metacognitive reading strategies (i.e., making predictions, asking questions, summarizing, and clarifying) to new situations through the use of reciprocal teaching. The instructional plan involved up to 20 training sessions

from first introducing reading strategies to eventual independent transfer of those strategies to a variety of new materials.

In reciprocal teaching, teachers carefully explain and model four strategies: prediction, questioning, summarizing, and clarifying. The teacher and students then alternate roles in applying and giving feedback on each strategy. After the student understands a strategy, the student begins extensive guided practice of the strategy and receives praise or explanatory feedback on performance. Again, roles of learner and teacher alternate. In some situations, students alternate roles of student and teacher with each other. At the end of training, students in all studies demonstrated that they had learned the reading strategies and were able to independently use them with various content material. This conscious transfer of reading strategies to new situations is probably best categorized as high road transfer since it involves conscious thought and choices. Deciding whether it is near or far transfer is difficult to determine without arbitrarily deciding how different from practice materials the new materials must be to constitute far transfer.

Ehlinger (1989) taught adolescents to use a think-aloud strategy to monitor their reading comprehension. Think-alouds involve students reading and then pausing to orally practice the following components: make a prediction, make an analogy, discuss any confusion, and use fix-up strategies. Sixty-four eighth-grade students learned think-alouds over a period of three 45-minute training sessions in one of three conditions:

- *passive modeling*, in which students simply heard the teacher model thinking-aloud strategies while reading in each session;
- *active modeling*, in which students observed modeling and then practiced thinking aloud and received feedback; and
- *full range modeling*, in which students were provided with a rationale for the modeling activity and a self-efficacy "pep-talk" before observing modeling, practicing think-alouds, and receiving feedback.

Students in the final two conditions were significantly better able to monitor their own reading comprehension and reported significantly more transfer of the think-aloud strategies to school classes other than the one in which the strategy was learned. They also provided significantly more responses to the question, "How has the think-aloud helped you?" Since the strategies are mindfully chosen and applied, this would most appropriately be called high road transfer. Since students reported applying the strategy in several classes, both near and far transfer appear to have occurred.

Weisberg and Balajthy (1989) use explicit instruction, modeling, practice, and feedback to teach below average high school readers to do summary writing and develop graphic organizers. Training took place during six 40-minute training sessions over an eight-week period. All students demonstrated their abilities to summarize and develop graphic organizers. One month after training, students were asked to transfer their learning to two real-world social studies passages—nuclear power plant disasters and the death penalty. For both passages, students demonstrated their abilities to

transfer what they had learned to new materials. Again, because the strategies were mindfully chosen, the study appears to be assessing high road transfer. Instruction centered on social studies text passages, so transfer appears to be near transfer to other social studies passages.

Mikulecky, Clark, and McIntyre-Adams (1989) developed three interactive computer programs to guide undergraduate students to concept map biology textbook chapters using modeling, practice, and feedback. The three 30-40 minute programs taught students to identify key ideas, compare and contrast those ideas, and graphically map how the ideas related to each other. Fifty undergraduate biology students, matched by SAT scores, were assigned to either a treatment or a control condition. In the treatment condition, students used computer programs to guide them through reading a textbook chapter on embryo development. At the end of the third session, students took a chapter examination asking them to apply the strategies they had learned. After the third session, students returned for a transfer task in which students were to read a new biology chapter on blood composition and be tested on identifying key ideas, comparing and contrasting those ideas, and graphically mapping the ideas. The control group read the embryonic development chapter and took a chapter examination. The group then returned a week later to read the blood composition chapter and take that chapter examination. The treatment group scored significantly higher on all portions of the first chapter examination, and this advantage held for the transfer chapter a week later. In each case, the students performed about a grade level better. In addition, the treatment group also outperformed the control group on a test given in a biology class that had not been designed as part of this study. A majority of students in post-experiment interviews were able to suggest ways they might apply what they had learned to other classes. The strategies learned in this study are best termed high road because they were usually mindfully applied. The transfer of strategies from one biology chapter to another is best described as near transfer, though many students expressed intention to apply strategies to other subject areas, which would be far transfer.

COOPERATIVE/SOCIAL GROUP STUDIES

Several literacy learning studies indicate that learning in social groups and pairs can provide enough interaction to facilitate transfer to new situations. A major area of study involves cooperative learning. Cooperative learning situations in literacy usually involve two or more students working together to improve their understanding of text or to retain material in texts.

Studies in this area have been performed by McDonald et al. (1985) and O'Donnell et al. (1985, 1987). McDonald et al. (1985) taught cooperating pairs of undergraduates to use and transfer reading strategies for summarizing important ideas by listening and correcting summary mistakes of others. O'Donnell et al. (1985, 1987) demonstrated that undergraduates, participating in cooperative editing groups to write and refine operating instructions for automobiles, could transfer their newly learned expertise to individually writing directions for operating a tape recorder. Various other techniques for using pairs or social groups to learn and transfer literacy comprehension strategies have been examined by Larson et al. (1985).

In O'Donnell et al. (1985), investigators examined whether cooperative dyad, or pair, work in a writing instruction task would transfer to new individual writing tasks. College students were randomly assigned to either a cooperative dyad or an individual condition. Students in the cooperative dyads were asked to cooperatively write instructional directions on starting a car and driving it away from the curb. No guidelines were given on how to interact or about how to cooperate. Students in the individual groups were asked to write directions to this same task. In session two, participants worked alone to complete the second writing instruction task (transfer task) on writing directions for how to operate a tape recorder and play back a conversation. Investigators found that students working in dyads outperformed the individuals on both communicativeness and completeness, and transferred this cooperative learning to independent work on the transfer task. This finding of cooperative dyads facilitating transfer in writing and editing tasks was further confirmed in a similar study, O'Donnell Larson, Dansereau, and Rocklin (1986). In a third study which involved rewriting rather than editing, O'Donnell et al. (1987) did not find the improved transfer effect for cooperative dyads. The investigators suggest that more than one experience in rewriting is necessary for internalization and subsequent transfer to independent writing tasks.

Investigators (McDonald et al., 1985) studied the effects of a systematic cooperative learning strategy on the acquisition of college text material and on transfer of strategy skills to independent learning. Two experiments were conducted of three sessions each. College students were randomly assigned to one of three groups: system group, no-system group, and individual study. The strategy system required each member of the pair to read about 500 words of a 2,500 word passage. One member of the pair acted as recaller and tried to summarize from memory what had been learned. The other member acted as facilitator/listener and tried to correct the errors in the recall and facilitate the learning by elaborating on the material learned. The partners alternated roles. Results indicate that the system pairs and the no-systems pairs significantly outperformed the individual study group. Using a systematic study strategy in pairs transferred to later individual performance. Students who study in pairs using a systematic learning strategy outperformed students who studied alone in an initial learning task, and this benefit transferred to an independent learning situation. Examiners suggest that transfer occurred because of the combination of the strategy and the pair interaction.

Larson et al. (1985) investigated the effectiveness upon transfer of metacognitive and elaborative activities in varying cooperative learning contexts. These investigators examined the importance of listener activity by assessing three types of dyads: (a) those that emphasized metacognitive activity (jointly using study strategies), (b) those that emphasized elaborative activity (jointly going beyond ideas in the text), and (c) those in which the listener remained silent. Results demonstrated that metacognitive groups outperformed the elaborative group and the control/passive group on initial acquisition of textbook information. On the independent transfer passage, the elaborative group outperformed both the metacognitive and control groups. Larson et al. conclude that the elaborative group facilitates transfer to individual learning because the elaborative strategies were internalized,

whereas the metacognitive groups seemed to use each other to improve performance but did not internalize and transfer the strategies.

The studies described above outline a pattern of situations in which cooperative learning facilitates the transfer of literacy abilities and strategies. Transfer appears to occur when there is sufficient time to practice strategies, and when the cooperative activity calls for the learner to internalize what has been learned. When this does not occur (i.e., when a second person serves as a mental coach and metacognitive monitor), then transfer does not occur. Most of the studies described above instruct learners in a mindful strategy and thus seem to address high road transfer. It is unclear whether the writing and editing studies involved mindful strategies (high road) or internalized, automatic processes (low road). It may be that some of both sorts of transfer were involved. In terms of near and far transfer, the studies above are probably best described as mid-distance transfer.

COGNITIVE APPRENTICESHIPS

Berryman and Bailey (1992), in *The Double Helix of Education and the Economy*, have examined the mismatch between most schooling and the sorts of higher level use of skills called for in the changed global economy. After reviewing the extensive body of research on transfer, they conclude: "We know now that certain practices of schools impede learning. More effective learning may not be sufficient for transfer, but poor initial learning will certainly impede it" (p. 49). These authors, drawing upon the work of Resnick (1987) and others, suggest a "cognitive apprenticeship" model for any learning which is to have application or transfer to the workplace. This model is extensive and requires teachers to play new roles and for instruction to be a good deal more organized and thought-out than is currently the case. The content, methods, sequencing, and sociology of a cognitive apprenticeship model of learning, as presented by Berryman and Bailey (1992, pp. 90-96), are outlined below.

Content: Teach the background knowledge about a domain and how to perform within that domain at the same time. This means that instruction must integrate

- domain knowledge (i.e., concepts and facts),
- tricks of the trade (i.e., strategies use by experts),
- cognitive management strategies (i.e., goal setting, planning, monitoring), and
- learning strategies (i.e., finding and reorganizing knowledge).

Methods: Teach in a way that gives students a chance to observe, engage in, invent, and discover expert strategies in context. This means employing many of the following methods:

- modeling (i.e., demonstrating expert performance),
- coaching (i.e., offering hints, support, feedback, reminders),

- scaffolding and fading (i.e., starting with a scaffold of teacher support and through several practices having that support fade),
- articulation (i.e., any method to get students to articulate or explain their invisible thought processes),
- reflection (i.e., any method that allows students to compare their performance and processes to those of experts), and
- exploration (i.e., any device that forces students into new problem solving on their own).

Sequencing: Stage learning in a way that builds multiple skills and allows the learner to discover what can be generalized. This means instruction must be designed with

- increasing complexity (i.e., from simple to requiring more and more skills and concepts for performance),
- increasing diversity (i.e., choosing a wide enough variety of tasks for students to see both the possibilities and limits of transfer), and
- global before local skills (i.e., develop a strong sense of the overall terrain—how this will be used—before the details).

Sociology: The learning environment should reproduce the technological, social, chronological, and motivational characteristics of real-world situations. This means

- situated or contextualized learning (i.e., real tasks like using reading and writing in an electronic message system to communicate questions and advice),
- community of expert practice (i.e., experts and learners work together to perform tasks so learners can progress toward expertise),
- intrinsically motivated learning (i.e., students engage in tasks that make sense to the learner and are interesting in their own right),
- cooperative learning (i.e., students of varying abilities working together to solve problems), and
- competitive learning (i.e., competing against other teams, previous performance, and expert performance; focus on strengths and weaknesses for improved performance).

Most current adult literacy instruction involves an instructor providing general practice exercises and some feedback for learners who are attempting to improve their general literacy abilities. Devising adult literacy learning experiences that incorporate the elements of a cognitive apprenticeship model would be challenging and involve the total restructuring of most adult literacy instruction. The model provides a clear, well-conceived framework for instruction, and it is based upon what research suggests is a likely pathway to transfer. It also implies a good deal more than the few weekly hours of drop-in voluntary attendance in adult literacy and workplace literacy classes that typify current practice.

BROADER DEFINITIONS OF LITERACY TRANSFER

Most of the research exploring the nature of transfer reported in this report defines transfer fairly narrowly (i.e., how well do specifically defined strategies or learnings transfer to new situations) or correlationally (how well do literacy test scores correlate with each other or with some other area of performance). Lytle (1990) has studied adult low-level literates using more long-term and ethnographic methods for detecting changes as adults improve in literacy abilities. Although her work does not directly address the issue of transfer, Lytle's observations from comments made by learners in self-reflection journals suggest an expanded definition of transfer. Lytle observes that improved literacy abilities among adults often involve lifestyle changes that precede or parallel improved literacy performance. Comments from successful learners' journals indicate incremental changes in

- beliefs about what literate behavior is and about one's own literacy ability,
- literacy practices away from the classroom,
- literacy processes and strategies deemed appropriate for different tasks, and
- plans for one's education and literacy use in the future.

It may be that such changes in lifestyle and perception of self are necessary for any meaningful transfer of literacy abilities in the everyday sense.

Mikulecky and Lloyd (1992) included interview and questionnaire items in their workplace literacy program assessments to measure changes in the areas mentioned by Lytle (1990). They found that such changes did occur in some programs, but only when instruction directly addressed improving learner beliefs, literacy practices, processes and strategies, or plans for the future. Changes in learners' beliefs about their literacy abilities and changes in literacy practices away from the classroom were almost always associated with improvement in measured literacy performance.

Bandura (1989) has examined the role of belief in relation to changed performance using the concept of *perceived self-efficacy*. Bandura and others have determined that learners who believe they can be effective tend to continue trying and learn from initial mistakes whereas those who do not hold such beliefs tend to be hampered by self-doubt and stop after an initial failure. Although tested ability is important in predicting future application performance, Bandura has found that perception of *self-efficacy* is slightly more important. For purposes of literacy transfer, it is likely that both improved ability and improved belief in one's ability are both important. This is an especially important finding for adults with low literacy abilities. Such adults have often failed regularly at literacy tasks and are hindered by both low ability and very low senses of their own abilities to be effective.

Atwell (1984) has used year-long case-study methods to describe changes in adolescent students immersed in a "literate environment" within her classes. Students read and write extensively to communicate with each other and with the teacher through response journals. Classroom activities

include brief modeling of literacy strategies imbedded in long-term group projects that involve the reading and writing of literature. Over the course of the year, Atwell reports several anecdotes documenting students' changed views of themselves in terms of literacy and changes in life-style as they begin to characterize themselves as readers and writers. These changes in self-perception and life-style are likely to be very important for long-term changes in literacy abilities and subsequent transfer. Developing life-long learners with a sense of competence for continued learning and who see themselves as part of a literate community may be as important as teaching for direct transfer of learning. In one sense, choosing a literate life-style might be an extended expression of Salomon's high road notion of transfer.

CONCLUSIONS

Literacy ability does transfer to some degree. However, most studies reveal a relatively low degree of correlation between reading performance with different sorts of material requiring differing background knowledge and reading strategies. The aspects of literacy which do transfer may be attributable to the very basic, internalized aspects of reading (i.e., how to move eyes over a page, recognizing letter/sound relationships, recognizing very basic vocabulary). Practicing reading enough to internalize and make these basic processes automatic appears to transfer. Thus, for low literate adults, it seems advisable to provide several hundred hours of practice with materials within the reach of the learner to insure that this sort of low road transfer is obtained. Furthermore, research among learning-disabled adolescents indicates that learning disability does not preclude transfer, though it may make it more difficult to obtain high levels of performance.

Learning to transfer mindful, high road strategies (i.e., summarizing, problem solving, studying, writing for multiple audiences, editing, etc.) does not appear to transfer as automatically. Several studies have documented that this kind of transfer is possible—at least to tasks that highly resemble the original learning task (i.e., near transfer). Instructional methods demonstrating transfer employed a good deal of focused practice on the part of learners and were often characterized by extensive modeling and elaborated feedback. Some cooperative learning strategies (where learners are encouraged to internalize newly learned strategies) seem to facilitate transfer to new situations. The cognitive apprenticeship model offered by Berryman and Bailey (1992) incorporates modeling, feedback, cooperative learning, and realistic social contexts. It is the most fully developed outline for how to achieve transfer of learning and also the most difficult to accomplish. Having adults work cooperatively to improve literacy while involved in authentic tasks that use literacy appears to be the best context to foster high road transfer.

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