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COGNITIVE-TRAINING PROGRAMS FOR OLDER ADULTS: WHAT ARE THEY AND CAN THEY ENHANCE MENTAL FITNESS?

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People are living longer, and in better physical health, than at any other time in history. But what of their mental health? Does it decline with age, offsetting the gains made in physical health and longevity? Can it be maintained? Can it improve? A review of the literature suggests that cognitive decline is not universal, pervasive, or irreversible. It also demonstrates that older adults can benefit from cognitive training. The challenge, however, is to provide such training in ways that are acceptable to older adults. The answer is to be found, firstly, in research that identifies best practices for cognitive skill development in ecologically valid activities involving older adults, psychologists, and adult educators. These best practices can then serve to assist educators to design continuing education programs and other activities that are readily accessible, affordable, and enjoyable.

The proportion of the Canadian population aged 65 or older is growing at an astonishing rate. In 1901, that segment represented just 5% of the total Canadian population. By 2007, it is estimated that this segment will represent over 21% of the total population (Thompson & Foth, 2003). Not only is this segment getting proportionately larger, it is also living longer. In 1921, life expectancy at birth was

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about 58 years for a Canadian woman and 57 for a Canadian man. However, a woman who reached the age of 65 in 1921 could expect to live another 14 years; a man another 13 years (Menard, 2003). Today, a 65 year-old Canadian woman can expect to live about 21 more years, a Canadian man another 17 years (Canadian Pension Plan Actuarial Report, 1997). In short, more and more Canadians are living longer and longer. This demographic transformation has profound implications for pension plans, the provision of health care, housing, families, the leisure and recreation industries, and, in the minds of older adults, for their physical and mental fitness. With respect to the latter, many older adults appear to believe that Shakespeare accurately characterized that which they fear in his description of the seventh age of man:

> Last scene of all,
> That ends this strange eventful history,
> Is second childishness and mere oblivion,
> Sans teeth, sans eyes, sans taste, sans everything.
> (*As You Like It.* Act ii, Scene 7.)

One of the concerns associated with an aging population is a higher incidence of persons suffering from age-related declines in cognitive functioning. Rowe and Kahn (1998) observed that loss of physical or mental function can threaten the opportunity of older adults to live independently. This, in turn, can contribute to older persons worrying excessively about declining cognitive function. More generally, some studies have reported that memory-related concerns are one of the most widely reported complaints associated with aging (Aldwin, 1990; Lachman, 2000; McDougall, 2000; Zarit, Cole, & Guider, 1981). Fear about Alzheimer's disease, with its initial symptoms of memory loss, is also never far from the thoughts of older adults when they forget someone's name or where they left the car keys, even though only about 10% of the population over age 65 will experience this disease (Rowe & Kahn, 1998). Are these fears and complaints justified, and is there anything that can be done to arrest age-related cognitive decline or improve cognitive functioning?

What is known about age-related cognitive declines? Many myths are associated with the effects of aging. For example, our society harbors a pervasive and persistent view that the process of aging is associated with universal, pervasive, and irreversible decline in cognitive functioning (see for example Lachman, 1991; Lamdin & Fugate, 1997; Mannheimer, Snodgrass, & Moskow-McKenzie, 1995; Rowe

& Kahn, 1998; Schaie & Willis, 1991). This decline is understood to be universal in that no one is exempt from its effects; it is pervasive in that it is believed to affect an extensive array of intellectual functions; and it is irreversible in that its deleterious effects may sometimes be slowed through intervention, but they cannot be reversed. Perlmutter and Hall (1992) provided an interesting contrast to the concepts of human "development" and "aging." They proposed that as recently as the latter half of the 20th century, these terms were associated with particular phases of the life cycle. Development was a concept associated with gains, and represented age-related changes from conception to maturity. Gains were characterized by structural growth, improved function, and increased environmental adaptation. By contrast, aging was associated with losses, and represented age-related changes following maturity. Losses were characterized by structural decay and functional deterioration. Moreover, the negative effects of aging were considered to affect both physical and cognitive abilities.

Over the course of the 20th century there was a significant amount of research investigating age-related changes in cognitive function. Woodruff-Pak (1989) proposed that research on age-related changes in intelligence can be seen to have evolved through four distinct phases during the past century. Phase I was characterized by the view that there is a steep and inevitable age-related decline in intelligence. She identified the results of the widespread intelligence testing undertaken by the United States Army in the second decade of the 20th century as a major contributor to this view. Moreover, she claimed that the view of age-related decline in intelligence was a dominant perspective in the psychology of aging for more than 30 years—from the 1920s to the 1950s. She observed that this view was so pervasive that the standardized scores for the Wechsler Adult Intelligence Scale (WAIS) were constructed so as to conform with declining intelligence as we age. In light of these research studies, and the resulting widespread acceptance amongst researchers of age-related declines in cognitive functioning, it is not surprising that this view persists amongst the general public.

A further illustration of this persistent view can be seen in more recent surveys of older adults regarding their perceptions of their memory. Aldwin (1990) surveyed older adults to examine the types of problems they faced. The most frequently mentioned complaint was deterioration of memory. Lachman (2000) reported that 39% of a sample of persons aged 25–75 reported having memory problems at least once a week. McDougall (2000) reported that older adults are fearful of losing memory ability and proposed that studies indicate that declining memory is one of the most widespread complaints associated with aging. Rowe and Kahn (1998) proposed that older people worry excessively about losing mental abilities and that fears of cognitive loss are widespread among older people. Zarit et al. (1981) reported that community surveys indicate that one-half of people over the age of 60 report serious memory problems. In summary, there is considerable survey evidence that loss of cognitive function, and especially loss of memory abilities, are widespread concerns among older adults. At the same time, there is considerable evidence that there is a lack of congruence between objective measures of memory performance and subjective perceptions. For example, Floyd and Scogin (1997) reported that there is a weak association between objective measures of memory performance and subjective assessments. They noted that there are several possible explanations for this finding, and that one possibility is an acceptance by many older adults of the widespread view that memory loss is an inevitable consequence of aging.

But what have we learned about age-related decline in research conducted since the 1950s? Does more recent research support the view that age-related declines in cognitive function are universal, pervasive, and irreversible? Perlmutter and Hall (1992) reported that while this view is still widely held by many in the general public, it is fading among researchers.

One of the challenges in examining the effects of aging upon cognitive abilities has been the limitations of the research methodologies employed. Much of the research has employed cross-sectional comparisons of younger and older groups of adults. This methodology does not separate the effects of cohort effects, and there are a number of other disadvantages and limitations of this approach (see, for example, Cavanagh & Blanchard-Fields, 2002). Studies utilizing a cross-sectional approach were typical of the Phase I studies discussed by Woodruff-Pak (1989), and the dramatic age-related losses reported by these studies were consequences of both aging and cohort effects. Phase II was precipitated by the emergence of longitudinal studies. These studies reported much greater stability of cognitive functioning than the cross-sectional studies had found (Woodruff-Pak, 1989). But longitudinal studies have their own disadvantages and limitations. For example, while they do not confound cohort effects with age-related changes, they do confound the time-of-measurement with age-related changes. Schaie introduced sequential research designs as a way of overcoming the major limitations of cross-sectional and simple longitudinal studies (Cavanagh & Blanchard-Fields, 2002). These designs permitted more careful control of the confounding effects of variables such as cohort effects and time-of-measurement effects. Accordingly, they have allowed us to reexamine the question of whether there are universal, pervasive, and irreversible age-related declines in cognitive functioning.

Are there universal age-related declines in cognitive function? There is considerable evidence that the average performance of older adults declines with age, but that there is significant interindividual variability (Nelson & Dannefer, 1992). Schaie (1994) reported that reliable average decrement was found for all cognitive abilities by the age of 67. Nonetheless, he found that there are significant differences in individual performance levels. Decrements were found for some study participants by age 53 while fewer than half of those aged 81 showed reliable decrements over the previous 7 years. He identified a number of variables that lead to early decrement for some persons, and high levels of functioning for others into very advanced age. One of these variables was the level of involvement in activities typically available in complex and intellectually stimulating environments. Such activities include extensive reading, travel, and continuing education activities. Similarly, Christensen et al. (1999) reported that age-related interindividual variability increased for memory, spatial functioning, and speed, but not for crystallized intelligence. They reported that factors associated with increased variability included gender, muscle strength, and symptoms of illness and depression. By contrast, a study by Lindenberger and Baltes (1997) reported relatively small interindividual differences in intellectual functioning after age 70. They speculated that their findings may have been influenced by the fact that their sample consisted of old and very old subjects (70–103 years of age), whereas most other studies examined the interindividual variability in younger adults. In any case, there is considerable evidence that the interindividual variability in cognitive functioning increases throughout adulthood—although this level of variability may decrease among the very old.

Are there pervasive age-related declines in cognitive functioning? Schulz and Salthouse (1999) reported that one of the many myths associated with aging is that there is a universal decline in intelligence with increasing age, resulting in serious and widespread deterioration in intellectual ability in old age. Willis and Schaie (1999) reported on age-related changes in six basic mental abilities: vocabulary (verbal ability), verbal memory, number (numeric skill), spatial orientation, inductive reasoning, and perceptual speed. They concluded that there are modestly positive age-related changes from 25 until age 60 in inductive reasoning, spatial orientation, verbal ability, and verbal memory. Indeed, the highest level of functioning on these four types of ability occurs in middle age. On the other hand, there are significant declines in numeric skill and perceptual speed from the age of 25 to 60. Accordingly, Schaie (1994) has concluded that there is no uniform pattern of age-related change across all intellectual abilities. Consequently, he rejects the utility of attempting to determine an overall index of intellectual functioning such as an IQ score. Baltes, Staudinger, and Lindenberger (1999) reported that reasoning, spatial orientation, and perceptual speed show linear decline during adulthood, with some further acceleration in very old age. In contrast, verbal knowledge (e.g., semantic memory) and certain facets of numerical ability have weak, and sometimes positive, age-related development up to the 6th or 7th decade of life, and start to decline only in very old age. They concluded that there are coexisting gains and losses throughout the lifespan. Another perspective which argues for the differential development of various cognitive skills is the distinction between crystallized and fluid intelligence (Cavanagh & Blanchard-Fields, 2002). Fluid intelligence consists of the abilities associated with flexible and adaptive thinking, which allow you to draw inferences, and which assist you to understand the relations between concepts independent of acquired knowledge and experience. Fluid intelligence includes such abilities as inductive reasoning, integration, and abstract thinking. By contrast, crystallized intelligence consists of the knowledge that you have acquired through education and experience. It includes such abilities as verbal comprehension and vocabulary. Research has confirmed that fluid intelligence declines significantly throughout adulthood, whereas crystallized intelligence improves. Moreover, interindividual differences in crystallized intelligence increase with age, whereas differences between individuals in fluid intelligence remain small over time (Horn & Hofer, 1992). A number of other reports have supported the view that there is significant age-related intraindividual variability in cognitive functioning (Christensen, 2001; Willis & Schaie, 1986). In summary, researchers in fields such as gerontology and developmental psychology believe that there are significant age-related changes in cognitive functioning. But the nature of these changes is multidirectional. At any point in their lifecycle, each adult will have some cognitive abilities that are declining, while others are stable and still others are improving. In short, there is considerable age-related intraindividual variability in cognitive functioning.

Are there irreversible declines in age-related cognitive functioning? Efforts to improve cognitive functioning, such as memory enhancement techniques, have a long history stretching back to the ancient Greeks (Connor, 2001; Yates, 1966). But cognitive training intervention programs for older adults have only been the subject of serious research since the early 1970s. Woodruff-Pak (1989) identified Phase III of the research on intelligence and aging as based upon an assumption that we could manipulate age differences in psychometric intelligence through intervention strategies. Phase III studies marked a shift from those of Phases I and II, which were of a descriptive nature, to studies that were experimental in nature. For example, the MacArthur Foundation Study of Aging (Rowe & Kahn, 1998) examined whether decreases in mental function can be prevented, and whether older people can increase any of their mental abilities. They identified several factors that prevent age-related cognitive decline, or at least minimize such decline. Some of these are beyond individual control, such as genetic factors, but others can be undertaken at any age. For example, they identified strenuous physical activity, and self-efficacy as factors that contributed to high levels of cognitive functioning. Cognitive intervention research has examined the modification of primary mental abilities (Willis & Schaie, 1999), and other areas of cognitive functioning including memory, problem solving, and perceptual speed (Cavanagh & Blanchard-Fields, 2002). A comprehensive study research program, which examined the modifiability of intellectual functioning in later adulthood and old age, was the Penn State Adult Development and Enrichment Project (ADEPT). Baltes and Willis (1982) examined the effects of training on three dimensions of fluid intelligence (figural relations, induction, and attention/memory). They reported that the training effects were strongest for figural relations, and concluded that intellectual decline in the 60s and 70s (if it occurs) can be slowed down, halted, or even reversed through cognitive training interventions. Verhaeghen, Marcoen, and Goossens (1992) conducted a metaanalysis of studies investigating memory improvement in older adults through mnemonic training. They found that there was significantly improved performance resulting from training, but they noted that there were improvements resulting from retesting alone. They concluded that memory remains plastic even in old age. A wide range of other studies have confirmed that cognitive training intervention programs improve cognitive functioning in older adults (Ball et al., 2002; Cavallini, Pagnin, & Vecchi, 2003; Dellefield & McDougall, 1996; McDougall, 2000; Schaie, 1996a, 1996b; Scogin, Prohaska, & Weeks, 1998; Singer, Lindenberger, & Baltes, 2003; Stigsdotter-Neely & Bäckman, 1993, 1995; Troyer, 2001; Willis, 1990; Yesavage, Sheikh, Friedman, & Tanke, 1990). In summary, there is ample evidence that age-related declines in cognitive functioning for healthy older adults are reversible through cognitive training intervention programs.

SUMMARY OF RESEARCH ON COGNITIVE-INTERVENTION STRATEGIES

From the above we know that there is substantial evidence that cognitive training intervention programs are effective for older adults. But this general conclusion raises a host of related questions. Who were the participants in these programs and how were they selected? What cognitive skills are we able to develop? What is the nature of the training intervention? What tests are used to determine whether these skills have been developed? Does the improvement in cognitive functioning have long-term benefits? Does the improvement resulting from cognitive training have generalized benefit? In short, if we sought to implement an optimal cognitive training intervention program for older adults, what guidance would be available from previous research? This next section examines these questions and identifies some areas requiring further research.

Who have been the participants in these programs and how have they been selected? The vast majority of participants in cognitive-training intervention studies have been healthy normal subjects aged 60 or more who have been free from cognitive problems caused by organic pathology. However, Rapp, Brenes, and Marsh (2002) selected participants with mild cognitive impairment. The age of participants has been quite variable. For example, Schmidt, Berg, and Deelman (2001a) had participants whose ages ranged from 45 to 84. By contrast, Singer et al. (2003) had participants whose ages ranged from 75 to 101. Verhaeghen et al. (1992) reported that the mean age for participants in the studies included in their metaanalysis ranged from 61.4 to 78. They also reported that while training interventions can lead to improved cognitive functioning even in old age, treatment gains were largest when the subjects were younger. Some studies specifically invited participants who complained of memory difficulties (e.g., Andrewes, Kinsella, & Murphy, 1996; Scogin & Bienias, 1988), while most simply invited anyone who was interested in participating in the training program. Some studies recruited participants from persons in an assisted-living facility (e.g., McDougall, 2000), but most were community dwelling individuals who were recruited through newspaper or other media announcements. A number of studies paid participants (Baltes & Willis, 1982; Dunlosky, Kubat-Silman, & Hertzog, 2003; McDougall, 2000; Rebok & Balcerak, 1989; Schaie & Willis, 1986; & Singer et al., 2003), but most studies did not report that any remuneration was provided to participants. Some studies accepted volunteers with no reported screening procedures (e.g. Cusack, Thompson & Rogers, 2003; Dellefield & McDougall, 1996). Others used extensive screening. For example, Ball et al. (2002) excluded participants who had a score less than 23 on the Mini-Mental State Exam (MMSE); had a self-reported diagnosis of Alzheimer disease; had experienced substantial functional decline (self-reported); had certain medical conditions that would predispose them to imminent functional decline or death (e.g., stroke within the past 12 months, certain cancers, or current cancer treatment); had self-reported losses in vision or hearing, or communicative ability (interviewer-rated). Derwinger, Stigsdotter-Neely, Persson, Hill, and Bäckman (2003) excluded persons with any of the following conditions: cerebrovascular accident, recent myocardial infarction, alcoholism, psychiatric illness, and primary degenerative brain disorders (e.g., Alzheimer's disease, Parkinson's disease, Huntington's disease). Other studies have screened participants for dementia (Andrewes et al., 1996), or depression (Yesavage et al., 1990). From this brief summary, it is apparent that the selection criteria for study participants is very variable. Moreover, even when a common selection measure is used, the standard for inclusion/exclusion is not always consistent, For example, several studies selected subjects based on their MMSE score. McDougall (2000) accepted participants with a score of 17 or more; Ball et al. (2002) used a score of 23 or higher; Brooks, Friedman, Pearman, Gray, and Yesavage (1999), and Yesavage et al. (1990) used a score of 27 or higher.

Mohs et al. (1998) cautioned that the selection criteria for subjects must be carefully considered. In their study they selected high-functioning (subjects had to have at least a 10th-grade education and an MMSE score above the 25th percentile relative to age and education) and found only modest improvement following the memory training program. They suggested that more robust improvement might have resulted if the subjects had poorer baseline performance. Scogin et al. (1998) reported a high level of attrition in their study, and concluded that most memory training programs are suited only for the well-motivated participant. Similarly, Yesavage et al. (1990) reported that some mnemonics, such as the method of loci, may be more difficult for some older adults. They suggested that further research is needed to examine the differential effectiveness of various cognitive training methods for different groups.

What Cognitive Skills are We Developing?

The vast majority of cognitive training intervention studies have sought to improve memory skills. This is not surprising since research has shown that declining memory is one of the most widespread complaints about aging. As Camp (1998) has noted, however, memory training has evolved from teaching a single mnemonic to multifactorial content programs. For example, McDougall (1999) has developed the Cognitive-Behavioral Model of Everyday Memory, which includes stress inoculation, health promotion, memory self-efficacy, and memory strategy training. Mohs et al. (1998) offered a comprehensive memory enhancement program, which consisted of the following components: how your memory works, stages in the processes of remembering, making the most of your memory, attention and concentration, making remembering easier, practice makes perfect, remembering text information, remembering names and faces, and maintaining memory improvements. Stigsdotter-Neely and Bäckman (1993) have taught the method of loci encoding together with attentional training and relaxation training. Verhaeghen et al. (1992) proposed that enhanced results might be obtained by including attention training and information about memory and aging. On the other hand, Stigsdotter-Neely (2000) reported that research has not confirmed that such multifactorial approaches are more effective than training in specific encoding skills. She did cite one study by Caprio-Prevette and Fry (1996), which demonstrated the superiority of the multifactorial approach; but, in general, multifactorial approaches do not appear to produce consistently better results. A few studies have emphasized that it is important to teach external memory strategies as well as internal memory strategies (Stigsdotter-Neely, 2000; Troyer, 2001). External memory aids rely on environmental resources such as notebooks or calendars, whereas internal memory aids rely on mental processes such as imagery.

A number of studies have attempted to develop a wider range of cognitive skills. For example, Ball et al. (2002) provided training to subjects in speed of processing and reasoning, as well as mnemonic strategies. Willis and Schaie (1986) examined cognitive training of spatial orientation and inductive reasoning.

A number of studies have proposed that participant attitudes and beliefs, including self-efficacy are important determinants of performance (Dellefield & McDougall, 1996; Lachman, 1991; McDougall, 1999; Rebok & Balcerak, 1989). Nonetheless, a number of studies have not supported this view (Mohs et al., 1998; Stigsdotter-Neely, 2000; West, Welch, & Yassuda, 2000). In addition, Rebok and Balcerak (1989) reported that self-efficacy beliefs of older adults are more resistant to change than those of younger adults. A number of studies have reported that there is a lack of congruence between objective and subjective measures of memory performance (Martin

& Zimprich, 2003; Rapp et al., 2002; Schmidt, Berg, & Deelman, 2001b; Scogin & Bienias, 1988; Zarit et al., 1981). On the other hand, Floyd and Scogin (1997) proposed that subjective assessments of memory performance are just as important as actual performance. Troyer (2001) and Mohs et al. (1998) proposed that improved subjective assessment of memory performance might be associated with improved functioning in everyday memory tasks, even if objective memory performance did not improve appreciably.

Two published reports of special relevance to this paper are those by Cusack, Thompson, and Rogers (2003), and Paggi and Hayslip (1999). Both reports detail cognitive intervention programs that were undertaken as training programs rather than research programs. Cusack et al. (2003) developed what they refer to as a Mental Fitness program. They provided an extensive training program consisting of eight all-day intensive workshops extending over 8 weeks. The program was a multifactorial one including; goal setting; critical thinking; learning and memory; and expressing ideas clearly. The training also included developing a positive mental attitude that included the following characteristics: optimism, mental flexibility, self-esteem and confidence, and a willingness to risk. Cusack and Thompson (2003) provided a detailed description of the components of the Mental Fitness program. Paggi and Hayslip (1999) developed the Mental Aerobics program based in part on spontaneous drills for creative thinking practice with Odyssey of the Mind teams. The content of their program included verbal problems, math problems, quizzes, spatial problems, and rebuses.

This brief review of the literature on cognitive-training intervention programs for older adults is sufficient to demonstrate a wide diversity in the content of these programs. This is not surprising in light of the wide range of cognitive skills in which decline may occur. Nonetheless, it raises some interesting questions. Are some cognitive skills easier to improve than others? Are some cognitive skills more important to improve than others? Are some training programs more effective than others in improving cognitive skills?

What is the Nature of the Training Intervention?

Apart from the diversity in program content discussed previously, there is a significant variation in the format of cognitive-training intervention programs. For example, there is a wide range in the duration of training programs. One of the most extensive training programs is the one undertaken by Baltes and Kliegl (1992) which consisted of 38 1-hour sessions distributed over 16 months. Their study consisted of an initial training program of 20 hours followed by a subsequent training program. They concluded that the subsequent training program produced little additional benefit. By contrast, Andrewes et al. (1996) provided a single 30-minute session and provided participants with a self-study memory handbook. The majority of training programs were 5–12 hours in duration. As noted earlier, Cusack et al. (2003) reported that their training sessions were all-day in length. Verhaeghen et al. (1992) conducted a metaanalysis of 33 studies and reported a range on the duration of each training session from 20 minutes to 2.5 hours. They found that longer sessions are less effective, and they attributed this to fatigue. Willis (1990) concluded that the greatest improvement occurs in the early stages of the cognitive-training program, and when training sessions are closely spaced.

A number of studies have reported that they provided pretraining sessions that consisted of training in imagery, semantic judgment, and relaxation training. Some studies have reported that such sessions are beneficial (Brooks et al., 1999; Floyd & Scogin, 1997; Verhaeghen et al., 1992). On the other hand, Stigsdotter-Neely (2000) reported that the effects of pretraining upon efficient mnemonic learning appear to be minimal, but may be especially appropriate when the mnemonic is complex and the training program is relatively brief. Brooks et al. (1999) concluded that pretraining sessions may be especially beneficial for the older-old (70 years or older). Other studies have utilized "booster" sessions in which follow-up training is provided after some considerable time has passed since the initial training. Some studies have reported that booster sessions were effective (Ball et al., 2002; McDougall, 1999; Rapp et al., 2002; Schaie, 1996a, 1996b). On the other hand, some studies have found no benefits resulting from booster sessions (Baltes & Willis, 1982; Scogin et al., 1998). In the study by Scogin et al. (1998), the booster sessions were provided after a period of only 3 months following initial training. The authors speculated that this might be too short a time for performance decay from the original training period to have occurred.

A variety of instructional formats has been utilized. Some studies have suggested that group sessions are beneficial (Zarit et al., 1981; Flynn & Storandt, 1990). Similarly, Verhaeghen et al. (1992) suggested that such sessions may be beneficial and should be investigated further. Mohs et al. (1998) reported that improved memory performance resulted from the use of group sessions even in the absence of memory training. On the other hand, some studies have reported no added benefit from the use of group sessions (Connor, 2001; Rasmusson, Rebok, Bylsma, & Brandt, 1999; Scogin et al., 1998).

Accordingly, it is not clear whether group sessions are consistently beneficial. It is entirely possible that group sessions are helpful with some groups of students but not others.

Certain studies have compared the effectiveness of various instructional formats other than, or in addition to, group instruction. Andrewes et al. (1996) gave their participants 30 minutes of individual training and provided them with a self-study memory handbook. Mohs et al. (1998) and Rapp et al. (2002) gave homework to participants in their memory training programs. Both studies reported improvement in subjective measures of memory performance, but not in actual memory performance. Flynn and Storandt (1990) compared the effectiveness of a self-instructional memory improvement program with the same program supplemented by group discussions. They reported greater improvement resulted from adding the group discussion sessions. Similarly, Baltes et al. (1989) reported that older adults demonstrated gains in cognitive skills through self-guided training which were equal to those gains resulting from tutor-guided training. Rasmusson et al. (1999) compared the effectiveness of three memory improvement programs: a group-based memory course, two self-paced, commercially available audiotape programs, and an individualized, microcomputer-based program. They concluded that improvements resulted from all three treatment conditions, but no one treatment was superior to the others. Rebok, Rasmusson, Bylsma, and Brandt (1997) tested the effectiveness of two commercially available audiocassette memory improvement programs. They found no improvement in memory performance, although they did report increased participant confidence in their memory abilities. Scogin et al. (1998) compared the effectiveness of three memory training programs for older adults: a self-taught memory training program, a group memory training program, and a combination of the first two approaches. No one approach was found to be superior, although they reported improvement in both memory performance and in participants' perceptions of memory performance. In summary, there is no clear and consistent evidence that any particular instructional format is uniformly superior.

Other studies have examined the effects of physical fitness on cognitive functioning. Many have reported mixed results (e.g., Khatri et al., 2001). Nonetheless, a metaanalysis by Colcombe and Kramer (2003) reported that aerobic fitness training could have a beneficial effect on the cognitive functioning of older adults. Rowe and Kahn (1998) and Rebok and Plude (2001) reached similar conclusions. Colcombe and Kramer (2003) reported that the duration of the training program was significant. Not surprisingly perhaps, long-term training programs (6 months or more) produced greater cognitive improvement than medium or short-duration programs. Additionally, moderate session duration (31–45 minutes) produced greater improvement than short (15–30 minute) or long (46–60 minute) sessions. They concluded that the moderating effects of the type of fitness training, program duration, and training-session duration should be systematically examined in future intervention research.

The wide range of formats used in these studies frustrates any systematic attempts to compare the results. Moreover, the lack of consistent results similarly frustrates any attempts to reach meaningful conclusions about which formats are most effective. Is there an optimal length for the duration of cognitive-training sessions and is there a optimal length to cognitive-training programs? Does pretraining achieve better results? Do group sessions achieve better results? These questions require further research efforts.

What tests have been used to determine if cognitive skills have been developed? A wide variety of tests has been used in research studies to determine whether older adults have benefited from cognitive-training programs. This is a consequence of at least three factors. First, there are different cognitive skills that have been taught. As noted previously, most studies have attempted to improve memory skills; but some studies have sought to improve other skills such as inductive reasoning, spatial orientation, and speed of processing. Accordingly, different tests are needed to assess different abilities. Second, some studies have emphasized the development of cognitive skills, whereas other studies have emphasized the development of positive attitudes (and some studies have investigated both). Different types of tests are needed to assess objective measures of performance and subjective assessment of performance. Third, some studies have emphasized the importance of using "ecological" tests of cognitive functioning—that is, tests which are relevant to the specific activities of daily living (Greenberg & Powers, 1987). This corresponds with Phase IV of Woodruff-Pak (1989) which proposed that research on intelligence and aging should utilize intelligence tests that are ecologically valid. These studies have proposed that the tasks or tests that are used to determine cognitive performance of older adults be meaningful ones. For example, Willis (1996) discussed the importance of studying improvements in *activities of daily living* (ADLs) such as self-care, and *instrumental activities of daily living* (IADLs) such as managing medications.

The wide range of tests that has been utilized in cognitive-training studies has greatly complicated the task of interpreting the collective results. For example, it is possible that one study that reported no significant results might have produced different results if a different set of tests had been employed. Moreover, some studies have either not undertaken an evaluation of the effectiveness of their training program (e.g., Paggi and Hayslip, 1999), or they have employed evaluation instruments which are not validated. For example, Cusack et al. (2003) developed an instrument called the Cusack-Thompson Mental Fitness Self-Assessment Scale. This tool was used to demonstrate the effectiveness of their training program, but no information was provided to establish the reliability and validity of the instrument.

Do Improvements in Cognitive Functioning have Long-Term Benefits?

Studies have investigated whether improvements resulting from cognitive training programs for older adults have lasting effects. Some studies have demonstrated long-term effects. For example, Schaie (1993) reported that the performance improvements persisted for 7 years. Stigsdotter-Neely and Bäckman (1993) reported that cognitive improvements were still evident 3.5 years after the training intervention. On the other hand, other studies have failed to show long-term benefits. For example, Schmidt et al. (2001a) reported that performance improvements were not maintained 3 months after the training intervention. Scogin and Bienias (1988) reported that 3 years after the training intervention, the memory performance was not significantly different than before training. Accordingly, the results of these studies are mixed. In light of the differences between these studies in selection of participants, method of training intervention, and tests employed to assess participant performance, it is conceivable that some training interventions have longer effects than others. Clearly, more research is needed on the duration of improvements in cognitive functioning arising from training interventions.

Does the Improvement Resulting from Cognitive Training have Generalized Benefit?

A number of studies have investigated whether the improvements in cognitive functioning arising from training interventions have a limited or more generalized benefit. This is one area in which there is nearly universal agreement across research studies. Performance improvements in cognitive functioning of older adults arising from training interventions tend to be specific to the skills taught and do not have more generalized benefit (e.g., Ball et al., 2002; Baltes et al., 1999; Derwinger et al., 2003; Schaie, 1996a, 1996b; Stigsdotter-Neely, 2000; Verhaeghen et al., 1992; West et al., 2000; Willis & Schaie, 1986). Schaie (1996a) observed that lack of generalizability (or what he calls "near transfer") is desirable in these studies since it offers evidence of convergent validity of the effectiveness of the training intervention. Generalizability (or what he calls "far transfer") of improvement in such studies might be a sign of a Hawthorne effect (Adair, 1984). If there is a Hawthorne effect, performance improvements might be a consequence of some other factor—such as the intensive contact with study participants—rather than a consequence of the training itself.

DISCUSSION AND CONCLUSIONS

People are living longer and, generally speaking, are in better physical health than at any other time in history. With the prospects of a relatively long time yet to live after age 65, often in good physical health for most of the time, many adults are now beginning to ask whether there are things they can be doing to keep themselves mentally fit. Can mental health be achieved in the same way that good nutritional practices and exercise programs are keeping them physically fit.

The answer is important because many people believe that all cognitive skills decline with age, and that it is only a question of time before they will need assistance with such instrumental tasks as balancing their check-books, shopping, and remembering where they live. For evidence of cognitive decline they point to their experience that their memory appears to be getting steadily worse as they get older.

Further support for the view of many people today that cognitive decline is inevitable comes from writings of the early part of the 20th Century. People who studied aging at that time, or reflected on it, concluded that age-related cognitive decline was universal, pervasive, and irreversible. However, researchers today no longer conclude that this is the case. The literature of the past 25 years clearly shows that, because of inter- and intraindividual differences, age-related cognitive decline is not universal or pervasive. It is also reversible.

Our literature review revealed that cognitive skills can be improved through training interventions. However, many questions still exist because of the nature of the samples of subjects selected and the tests used to measure cognitive abilities in the research. Memory skills have been researched most thoroughly, and a number of mnemonic techniques have been demonstrated to work over time for those people who are able to master the underlying system (e.g., method of loci, rhyming schemes). Such techniques are generally available to the public through self-help books, and also through organizations and institutions that offer memory-improvement programs.

If memory skills can be improved by training, can other skills such as problem solving, spatial orientation, numeric skills and inductive reasoning also be improved? The literature shows that they can. However, it also shows that cognitive-skills training interventions are specific to the skill taught. That is, mastering a technique to improve memory does not generalize to spatial orientation or inductive reasoning.

Given that cognitive skills can be developed and enhanced throughout life, what is the best method to do this for older adults who wish to be mentally fit? Many of the research findings about enhancing cognitive skills are based on artificial situations: using such things as nonsense syllables in memory experiments, and highly controlled geometric images flashed on a screen for spatial-orientation tests. Many older adults are unwilling to participate in these kinds of activities to develop their cognitive skills.

There are many things that older adults like to do that are generally thought of as contributing to mental fitness. This is despite the fact that they have not been properly evaluated as making a difference to mental fitness. Included are things like reading, travel, taking continuing education courses, memorizing poetry, singing in choirs, learning to play a musical instrument, surfing the internet, playing card games, and doing cross-word and jig-saw puzzles. How might interest in these activities be translated into valid cognitive-skill training programs to enhance mental fitness? Could such programs, for example, be provided by adult educators in readily accessible locations like school, college, and university campuses?

Paggi and Hayslip (1999) offer a possible model for enhancing some cognitive skills in an accessible location. Using people dropping in to a seniors' center and residents of a long-term care facility, they suggest participation in groups under the tutelage of a trained facilitator to solve math problems, puzzles, spatial problems, rebuses, etc. They believe such participation would lead to feelings of self-efficacy in older adults and help to dispel myths held by them that their cognitive skills are declining. These exercises, called "mental aerobics" by the authors, allow many older adults to "live vibrant mental lives" (p. 8). They note that these mental aerobics are not for everyone. In addition, they acknowledge that a formal evaluation of mental aerobics to enhance mental fitness—both short- and long-term—has yet to be carried out. As a result, it is difficult to know without further testing whether the mental aerobics exercises themselves, or the social facilitation that came from group participation, are critical to the apparent improvement in mental fitness.

The intensive workshop approach to mental fitness developed by the Mental Fitness for Life Program at Simon Fraser University (Cusack et al., 2003) also provides a possible model. It consists of offering an accessible program in a workshop format that many older adults have previously experienced. In this program, people participate in eight workshops where they learn about how ageist attitudes and beliefs can inhibit a mentally healthy old age. They also learn a number of cognitive skills including setting and achieving goals, critical thinking, and the ability to speak one's mind clearly. Using pre- and postworkshop measures of mental fitness as assessed by the Cusack-Thompson Mental-Fitness Self-Assessment Scale, the authors claim that the workshop intervention leads to significant improvement in mental fitness. Unfortunately, the reliability and validity of the self-assessment scale has yet to be determined. So, it is not known whether these results are real, or whether they might reflect the effect of simply participating with others in a group experience.

Despite the limitations of the Paggi and Hayslip (1999) work, and that of Cusack et al. (2003), we believe that the group participation models and training interventions they used merit further exploration—as much human learning takes place in a group situation, where learning is facilitated by a leader as well as by other learners. The acquisition of cognitive skills in groups does not, of course, suit all learners. For certain older adults, it might be better to customize training programs to suit particular individual needs (Scogin et al., 1998). Individuation of cognitive-training programs is, of course, costly. Therefore, it is not efficient when attempting to deal with large numbers of older adults in an affordable way. Group participation models are, therefore, more appropriate. In addition, older adults can, even in the group situation, have a major say in defining needs and goals. So, in general, the facilitative effects of individuation—or the learner-centered approach to learning, as it is more commonly known—can be experienced to a degree in the group.

As noted previously, there are many activities that older adults enjoy doing. It would seem, therefore, that incorporating the cognitive skill acquisition and skill practice into these activities would be a pleasurable and effective means of maintaining and developing mental fitness. For example, reading mystery novels has elements of both inductive and deductive reasoning. Encouraging people who like to read to participate in a mystery-novel reading club would be a means of encouraging and supporting the acquisition of reasoning skills. Successful traveling requires both problem solving abilities and spatial orientation. What better way to encourage problem solving and strengthen spatial orientation skills than through travel to interesting places for those people who like to travel!

What cognitive skills are necessary to learn music, to sing, to play a musical instrument? What skills are necessary to participate successfully in a continuing education course? What cognitive skills can be strengthened by playing card games and doing puzzles? By analyzing the cognitive skills inherent in these activities, we can better design and offer programs and activities for people who wish to acquire particular skills. This is much like doing specific physical exercises to develop certain parts of the body or for particular medical conditions (e.g., lifting weights to help increase bone density for people who suffer from osteoporosis).

How do we integrate our clinical knowledge of cognitive skills acquisition, maintenance, and development with adult education expertise to develop and offer mental fitness programs that will be both of interest and affordable to many older adults? Where do we start?

A number of studies have suggested that cognitive training programs should be constructed around the interests and cognitive skills of the participants. Accordingly, the type and amount of training would be determined by the desired competencies of the older adults (e.g., Lachman, 2000; Stigsdotter-Neely, 2000). Scogin et al. (1998) questioned whether we should attempt to determine through research studies which groups of older adults would benefit from which type of training. Instead, they proposed that the most efficient and effective strategy might be to simply ask the potential trainee for their preference. These conclusions have special implications for the design of educational organizations—such as university continuing-education units—that might want to develop mental fitness programs for older adults. The literature of adult education consistently advises that educational programs for adults should take account of the needs, interests, and preferences of participants (see for example, Apps, 1991; Brookfield, 1986; Cross, 1981; Houle, 1972; Knowles, 1980; Knox, 1986; Wlodkowski, 1999).

We expect that asking older adults what they would like to do to enhance their mental fitness will yield preferences for activities that they are now familiar with and enjoy. For example, we know that poetry courses and acting courses and related activities are popular with groups of older adults that have organized themselves into associations that often work in partnership with continuing-education departments of universities. The Learning is Forever (LIFE) Society that works in partnership with the G. Raymond Chang School of Continuing Education at Ryerson University is an example. As memorization of material is an important skill for actors, and for the enjoyment of poetry, one can envision research at Ryerson University, or elsewhere, in which older adults, adult educators, instructors, poets, directors of plays, and psychologists expert in learning and memory work together in focus groups. They would work in the laboratory, in the classroom, and on the stage to develop best practices for memorization and recall of material. These best practices might then be incorporated into other educational programs. They may be appropriate to other memory tasks that confront the older adult in their daily living. Measures of self-efficacy can also be taken to determine whether successful memorization leads to greater self-confidence in the older adult in dealing with their environment.

Cognitive skills other than memory may, we believe, be similarly analyzed and best practices identified for inclusion as part of the curriculum in other courses and activities of interest to older adults.

The authors believe that investment in research of this type will significantly increase our understanding of how to maintain and improve mental fitness in later life. This would be in the same way that significant investment over many years in research on nutrition and physical exercise is now paying off in the improved quality of physical life for older adults.

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