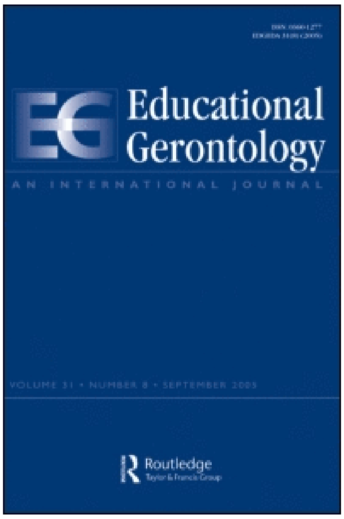

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Cognitive Changes Among Institutionalized Elderly People

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COGNITIVE CHANGES AMONG INSTITUTIONALIZED ELDERLY PEOPLE

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The efficiency of different cognitive training procedures in elderly people was studied. Two types of methods to train cognitive and memory functions were compared. One method was based on new technologies and the other one on pencil-and-paper activities. Thirty-six elderly institutionalized people aged 68–94 were trained. Quantitative and memory measurements were used. Results suggest that participants trained with specific software improved their objective memory scores. Pencil-and-paper training programs improved participants' subjective memory and health. This study also suggests that meta-memory issues must be trained no matter what training procedures are used.

A number of studies have revealed age-related impairment in several cognitive domains such as attention, learning, and memory (Park & Minear, 2004). Moreover, negative beliefs in older adults have a detrimental influence on motivation to learn new strategies that can solve their cognitive deficit. However, aging does not always mean a loss of cognitive functions. Extensive scientific evidence shows that older people can learn new competences, optimizing and/or compensating their motor, cognitive, and emotional-motivational repertoires

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(Ball et al., 2002). Plasticity of learning and changing capacity by means of experience is possible over the life span.

One of the greatest challenges of the 21st century is to link older people and technology. Nowadays, increases in the aging population are a well-documented issue (Stark-Wroblewski, Edelbaum, & Ryan, 2007). Similarly, Saunders (2004) described that the use of computers has dramatically increased in recent years and is expected to continue rising. The elderly could improve their quality of life if they knew how to use computers and technology.

Technology has extended to many areas such as health, communication, and education. Cognitive functions of elderly people have become a focus of interest to incorporate new technologies in order to improve the mental skills of the elderly (Mayhorn, Stronge, McLaughlin, & Rogers, 2004). Currently, many computer programs are being developed to improve cognitive functions of elderly people such as attention, language, perception, and memory. For example, there is the Brain Training program by Kawashima (2005). Other programs are more scientific and are applied in rehabilitation contexts with Alzheimer's patients, mild cognitive impairment, age-related cognitive impairment, and brain injury. Gradior by Intras and Mindfit by Breznitz are examples of cognitive software (Franco, Orihuela, Bueno, & Cid, 2000; CogniFit, 2003).

AGING AND COGNITIVE FUNCTION

Cognitive function in the elderly has two main characteristics. Cognitive development is multidimensional and multidirectional because changes are produced in different areas and take different directions (Santrock, 2006). According to life span psychology, people experience losses as they age, but they can also improve their cognitive abilities (Craik & Bialystok, 2006). This double phenomenon was described by Baltes & Singer (2001). They distinguished between the declining biology-driven cognitive mechanics and the maintained, or even increasing, culture-driven cognitive pragmatics. Beginning in early adulthood, the plasticity of the cognitive mechanics (reasoning, memory, and perceptual speed) decreases with advancing age. But the cognitive pragmatics "use" the culture, and the experiential and interpersonal contexts in which people develop, being able to exhibit lifelong positive expressions. Professional expertise, artistic competence, emotional intelligence, and wisdom are examples of late-life potentials in the cognitive pragmatics (Krampe & Charness, 2006).

AGING AND COGNITIVE PLASTICITY

Studies in neuropsychophysiology provide evidence of brain capacity to change through experience (Gruber & Müller, 2005). Neuroplasticity, such as brain capacity to modify and alter its structure and function (Fernández-Ballesteros, Zamarrón, Tárraga, Moya, & Iñiguez, 2003), is an important concept in cognitive rehabilitation (Levin, 2006). Maintaining cognitive functions in the elderly is explained by three aspects: (a) elderly people are physically active, (b) they are mentally active, and, (c) they have a good self-concept.

Although flexibility in learning allows cognitive functions to improve at any stage of life, there are limits and individual differences. Yang, Krampe, & Baltes (2006) agree with the existence of cognitive plasticity in people in their 60s and 70s according to previous studies (Krampe & Charness, 2006). Furthermore, Yang et al. (2006) researched whether cognitive plasticity continued to exist in the oldest people (participants' ages were 80+). On the one hand, this study demonstrated plasticity in participants aged between 70 and 79, and the most important finding was that plasticity continues in participants aged between 80 and 91. However, new or complex learning is still affected by advancing age. Therefore, when a new ability has to be learned (such as the loci method), there is less plasticity in the oldest people (Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, 2003).

COGNITIVE AND MEMORY TRAINING PROGRAMS

Literature distinguishes several variables involved in cognitive training programs. Some of these studies indicate that physical and aerobic exercises are important in improving mental abilities (Sumic, Michael, Carlson, Howieson, & Kaye, 2007). Other programs stress social participation to improve or maintain cognitive function (Fernández-Ballesteros, 2005). Others are only based on cognitive characteristics (such as attention, memory, and language) to optimize mental skills (Wadley et al., 2006). Others are more specific and only train memory (Cavallini, Pagnin, & Vecchi, 2003). More complete memory programs include other abilities such as attention, language, reasoning (Montejo, Montenegro, Reinoso, De Andres, & Claver, 2001).

MULTIFACTORIAL OR TRADITIONAL MEMORY TRAINING IN AGING

The most complete memory training programs should include four basic factors: encoding activities (e.g., repetition, organization, and mnemonics); subjective characteristics (social skills, verbal ability, beliefs, and emotional state); retrieval factors (type of memory test); and the nature of the materials (verbal, visual) (Stigsdotter-Neely, 2000). The main reason to use these multifactorial programs is that this approach can hopefully demonstrate that improvement is stronger, more durable, and generalized to different tasks than the gains made in traditional memory training. Stigsdotter-Neely (2000) analyzed the progress obtained by multifactor programs versus traditional programs. Neither type of program was better than the other, and both of them produced cognitive improvement. In addition, multifactor programs did not produce stronger results. In spite of these results, a multifactor approach can be more complete. If the aim of the study is to change beliefs and stereotypes about cognitive function in the elderly, the research should include these aspects in the program (Brehmer et al., 2008).

Another issue that has been researched is the relation between objective and subjective aspects of memory (Chasteen & Bhattacharyya, 2005). Some authors have the conviction that beliefs, perceptions, and knowledge that old people have about their memory influence memory performance (Desrichard & Köpetz, 2005). However, other studies did not find a relation between subjective and objective memory features (Schmidt, Berg, & Deelman, 2001). Turvey, Schultz, Arndt, Wallace, & Hertzog (2000) studied 5444 elderly participants. Although some participants had negative beliefs about their memory, they had successful results. These contradictory findings could explain the difficulty in researching the subjective aspects of cognitive functions. However, these studies show that there is an important relationship between objective and subjective characteristics of memory (Verhaeghen, 2000). Thus, there should be further research in this field.

COMPUTER-ASSISTED TRAINING OR PENCIL-AND-PAPER COGNITIVE TRAINING PROGRAMS

Computer training is being used to rehabilitate memory function in patients affected by brain injury (Kapur, Glisky, & Wilson, 2004). Old people that have age-related memory impairment or some kind of dementia are using this technology as well. However, there are few studies that demonstrate that computer-based training is better than pencil-and-paper cognitive programs in the rehabilitation of these patients (Chen, Thomas, Glueckauf, & Bracy, 1997; Skilbeck, & Roberston, 1992).

The present study is included within this framework and extends the research on the cognitive plasticity in the elderly. The aim is to integrate interest in elderly people, technology, and cognitive functions. This paper compares two types of methods to train cognitive and memory functions. One method is based on new technologies and the other is based on pencil-and-paper tasks. In addition, the timing was also taken into account considering that cognitive changes are slower in elderly people. Furthermore, this work includes a multifactor approach to the evaluation of the results and objective and subjective memory.

METHOD

Participants

A sample of 36 elderly people institutionalized at a nursing home participated in this study. At the beginning of the screening phase, the sample consisted of 51 participants, but the final sample was reduced to 36 people. Participants were aged 68–94 years (mean = 79.28, $SD = 6.5$). Of the participants, 86% had been living in the nursing home between 5 months and 9 years; 14% between 10 and 19 years (mean = 4.35, $SD = 4.7$); 31% were male; and 69% were female. The level of education was distributed as follows: 28% with no studies, 52% with primary school studies, 17% with secondary school studies, and 3% hold an university degree. Further, 78% had no diagnosis of neurological injury or brain accident, 64% had no dementia background, 61% were not physically or sensorially handicapped, 22% had visual or hearing difficulties, 17% had other deficits (such as limited mobility or a mixed handicap), and 61% did not take psychopharmacological treatment versus 39% of participants that did.

Measurements and Materials

The study consisted of four phases during which the following assessment was carried out.

Screening Phase

A total of 51 people were assessed with three different tests in order to choose the final sample. Three tests were administered in order to select the sample.

1. **GHQ-28. General Health Questionnaire (Goldberg, 1972): This is an assessment instrument to detect psychosocial**

problems, and help in the subsequent identification and qualitative evaluation of patients.

2. MEC. Mini-Exam Cognitive Test (Lobo, Escobar, & Gomez, 1979): This is widely used as a screening tool for dementia in epidemiological studies and in clinical contexts for a quick assessment when there is a possibility of cognitive impairment. The maximum score is 35.
3. GDS. Geriatric Depression Scale (Yesavage et al., 1983): This is a 30-item questionnaire in which participants are asked to respond about how they felt physically and mentally over the past week.

Pretraining Phase

After the screening phase, participants' objective and subjective memory and health profile were assessed.

Objective memory assessment. The following tests were used to assess objective memory:

1. Learning List of Associated Pairs: This is a version of the subtest of associated pairs included in the Wechsler Memory Scale-R Spanish version (Montejo et al., 1997). There are three types of scores: Total (0–24), learning (0–8) and delayed (0–8).
2. Rivermead Behavioural Memory Test (RBMT) (Wilson, Cockburn, & Baddeley, 1985): RBMT is a test for detecting everyday memory problems. It is useful for measuring memory changes after cognitive training. It provides a total score between 0–12. A performance over 9 means a normal memory, from 7 to 9 involves a weak memory, 3 to 6 average-memory impairment, and 0 to 2 severe memory impairment.

Subjective memory assessment. The test used for subjective memory assessment was the Memory Failures Everyday Life Test (MFE) (Suderland, Harris, & Gleave, 1984). MFE is a questionnaire about frequency of self-perceived memory failures of elderly people in everyday life. The questionnaire includes 28 items assessing memory failures. The score rate is between 0 and 56.

Health profile. The tool used to obtain a health profile for the participants was the Spanish version of the Nottingham Health Profile (NHP) (Alonso, Anto, & Moreno, 1990): It assesses participant's judgement of quality of life regarding health. This version includes 45 items in which participants are asked how they actually feel. Scores can be 0 to 45.

Training Phase
Three different training procedures were administered:

Software. The software used in the training phase was How to Improve Your Mental Skills (Navarro, Alcalde, Marchena, Ruiz, & Amar, 1996). This computer program includes three games for training cognitive functions:

1. The Ghost Book: This is a game designed to improve concentration skills. The game features a full library. One of the books moves slightly, and the user must click on the book. The game requires the user to focus and maintain attention for a few seconds trying to maintain the participant's attention consistently. The game is also helpful in improving reaction time since the computer requires a fast a response.
2. Match the Lines Task: This game presents a vertical line with a horizontal crossing line. Both lines are different lengths and generate an illusion, looking like different sized lines. Users have to increase the size of the vertical line until its length coincides with the horizontal one. The aim of this game is to improve concentration, attention, and perceptual skills.
3. Line Adjustment Task: This game presents a rectangular box with a line protruding from each side. Users are required to adjust the segment of the right side of the box so that it lines up perfectly with the segment on the left side. The result is a perfect straight line crossing through the rectangle. This game helps participants improve perceptual accuracy, which is needed to perform precision exercises.

All the above games have three levels of difficulty: easy, average, and hard. The computer will always give user feedback about performance and allow the participant to check the answers.

Pencil and Paper (P&P) program. For each participant, we used in each training session at least one exercize from each of the following pencil and paper training programs (a total of five per session).

1. U.M.A.M. Method. Practical Manual of Memory Assessment and Training (Montejo, Montenegro, Reinoso, De Andres, & Claver, 1997): This method includes numerous exercises with pictures and questions for acquisition, retention, and remembering information.
2. Memory 65+ Method (Cadavid & Dively, 2000): This is a practical program to teach cognitive strategies and train processes

of memory using pencil-and-paper exercises of attention, perception, loci method, name-face associations, and number chunks. The program also includes external memory aids such as notebooks, timetables, etc.

3. **Memory. Cognitive Stimulation and Maintaining Program (Maroto, 2003): This method includes exercises and strategies to prevent and solve age-related memory problems. Some strategies are organization, association, and visualization.**
4. **Cognitive Stimulation and Maintaining Program for Elderly People (Maroto, 2002): This specific P&P memory program includes a notebook with different exercises of cognitive and memory functions such as attention, verbal fluency, etc.**
5. **Memory Training Program (Imserso, 2002): This program was originally designed for Alzheimer's patients; however, its exercises can also train elderly people with age-related memory problems. The method includes language, calculation, visualization, and spatial orientation activities.**

Mixed training. In this training program, a combination of computer software and P&P training was administered.

Posttraining Phase

Different versions of the same tests as in the Pretraining Phase were administered to all participants.

Procedure

The study consisted of four phases: screening, pretraining, training and posttraining. Participants, had to get scores over 7 (CHQ), 22 (MEC), and less than 18 (GDS) in order to become a member of the final sample. Fifteen participants were rejected because they did not meet the criteria. A final sample of 36 participants was accepted. After the pretraining phase, participants were randomly assigned to six groups according to the type of training and the number of sessions to be received. Three groups received 38 sessions or more (from 38 to 64) ($n = 18$) and three groups less than 38 (from 9 to 37) ($n = 18$). In terms of training procedures, three study groups were created: Software group received computer based training ($n = 12$); P&P group received pencil and paper training ($n = 12$); and Mixed group received computer and pencil and paper training ($n = 12$). For half of each session, the Mixed group worked with the How to Improve Your Mental Skills software. The other half of the session the Mixed group worked with two activities from the P&P training programs. Each group received 30-minute sessions.

Both assessment and training sessions were conductedfrom 10:00 to 13:00 without interrupting other activities organized in the nursing home (reading, hobbies, lunch). Sessions were carried out in a comfortable room with a large table and four personal computers. Participants voluntarily agreed to take part in this study and to be videotaped during the training sessions. In addition, the study was approved by the manager and staff of the nursing home.

Experiment Design

Firstly, a preposttest design for paired samples was developed. Six independent subgroups were created. Two variables were considered to configure the six subgroups: group A_1 was trained with the software, A_2 was trained with P&P, and A_3 was trained with the Mixed training; B_1 received ≥ 38 sessions, and B_2 received <38 sessions. A 3×2 interparticipants-factorial design was done before and after training sessions in order to prove the confidence of the dependent variable in each phase. Participants were randomly assigned to the subgroups, and there was the same number of observations in each cell. Two independent variables were considered in this study. Type of cognitive training and number of sessions received. The dependent variables were the following: (a) total scores in the RBMT, (b) total scores in the List of Associated Pairs, (c) learning scores in the List of Associated Pairs, (d) delayed scores in the List of Associated Pairs, (e) total scores in the MFE, and (f) total scores in the NHP.

Hypothesis

The key conceptual hypothesis of this study was that type of training and number of sessions would improve scores in objective and subjective memory measurements.

RESULTS

In order to confirm that the all groups were homogeneous, an ANOVA for factorial design in the pretraining phase was calculated. The data analyses demonstrated that all groups were uniform before the cognitive training (RBMT: $F_2 = 1.438$; *ns*; PAIRS: $F_2 = 0.499$; *ns*; NHP: $F_2 = 1.438$; *ns*).

Groups were compared taking into account scores on all tests. The number of training sessions received was also considered. This was done by creating two different groups of participants, one of which

Table 1. Pre- and posttraining mean (*sd*) scores and Wilcoxon test for dependent variables for all groups of participants

	Pretraining (>38 sessions)		Posttraining (>38 sessions)				Pretraining (<38 sessions)		Posttraining (<38 sessions)			
Groups	Mean	*sd*	Mean	*sd*	*Z*	Sig.	Mean	*sd*	Mean	*sd*	*Z*	Sig.
Software	7.33	2.44	8.67	1.75	2.12	0.034*	8.83	2.48	7.33	2.73	2.06	0.039*
P&P	8.17	0.75	8.83	1.60	1.13	0.19	7.17	2.40	5.83	3.06	1.84	0.07
Mixed	9.38	0.98	8.33	1.21	1.91	0.06	9.83	1.60	8.33	2.56	1.85	0.06
Software	15.33	6.92	12.67	9.63	1.34	0.26	15.83	8.30	12.67	3.83	1.12	0.23
P&P	16.83	8.56	8.00	2.97	2.03	0.045*	10.83	9.46	10.00	8.29	0.63	0.53
Mixed	13.83	10.07	6.50	4.32	2.02	0.043*	13.50	9.71	8.67	6.86	1.89	0.06
Software	10.50	5.92	12.17	3.97	1.47	0.14	16.33	12.42	16.00	14.97	0.14	0.89
P&P	14.33	8.57	16.33	9.63	1.21	0.22	11.50	8.17	11.17	8.97	0.14	0.89
Mixed	17.17	9.97	13.17	6.97	1.99	0.046*	8.00	5.89	7.50	7.58	0.37	0.72
Software	12.67	4.63	15.00	4.43	1.05	0.29	14.50	6.28	10.17	4.87	2.21	0.027*
P&P	13.17	5.46	15.17	4.99	0.84	0.40	10.83	4.87	11.50	4.76	0.11	0.92
Mixed	12.00	4.19	11.67	5.92	0.63	0.53	12.67	5.89	14.83	2.86	1.06	0.29

*$p < .05$.

Note. Rivermead Behavioural Memory Test = RBMT; Memory Failures Everyday Life = MFE; Nottingham Health Profile = NHP; List of Associated Pairs = PAIRS.

received $\geq$38 training sessions and one that received <38 training sessions. Table 1 shows that learning was more efficient when participants received $\geq$38 training sessions. The Wilcoxon test comparing mean scores pre and posttraining sessions indicated significant RBMT scores in the software training group ($Z = -2.121$; $p < .05$). Statistically significant results were also found for the NHP test of the mixed training group ($Z = -1.99$; $p < .05$).

However, when <38 training sessions were received, statistically significant differences were infrequent. We found differences in RBMT mean scores for software training group ($Z = -2.06$; $p < .05$). The comparison pre and post-training sessions in PAIRS test for software group was also significant ($Z = -2.21$; $p < .05$). Figure 1 shows those mean differences pre and posttraining for three different groups within the assessment when participants received $\geq$38 training sessions.

The ANOVA comparison of combined effects for the 3×2 experimental design (training $\times$ sessions) found independent effect for the variables (Table 2).

ANOVA was statistically significant only when we compared scores in the PAIRS test. The mean of all groups was higher when they received $\geq$38 sessions (mean = 17.33) than when they received <38 sessions (mean = 16) ($F_{(2)} = 5.69$; $p < .008$).

We also compared the improvement and/or reduction (improvement &/or reduction = {posttraining score–pretraining score}) in scores in different dependent variables obtained by participants during the training (Table 3). A graphic view can be seen in Figure 2. Participants gained in the posttraining when they received $\geq$38 sessions in objective (RBMT) and subjective memory measurement (MFE).

DISCUSSION

The main goal of this study was to analyze the effect of different training procedures on the objective and subjective memory performance of elderly people. According to the data, a first effect was the type of training using specific software. This treatment was effective considering the RBMT scores for participants receiving $\geq$38 sessions ($Z = -2.121$; $p < .05$). However, when participants were trained with the software and received less than 38 sessions, results did not improve in RBMT ($Z = -2{,}060$; $p < .05$). The software group decreased its scores again in the posttest phase in List of Associated Pairs (Total Score) ($Z = -2{,}214$; $p < .05$). These results are probably due to the difficulty in computer use for older people. Elderly people

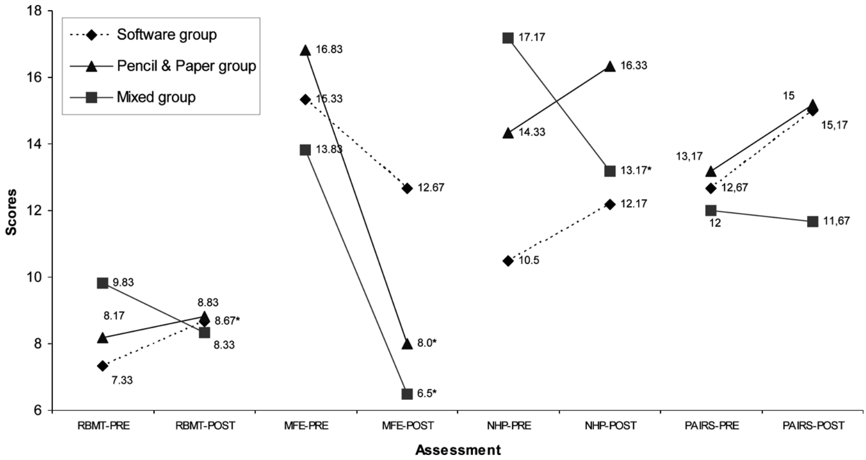

Figure 1. Pre- and posttraining mean scores and Wilcoxon test comparison.

needed a longer training to learn a new skill (Economou, Simos, & Papanicolaou, 2006; Czaja et al., 2006). They concur with the Stigsdotter-Neely (2000) study. He needed 32 sessions as the limit to improve their results. We used 38 training sessions in order to get some statistically significant differences. This may be explained by the type of learning ability. Stigsdotter-Neely (2000) only considered traditional training based on pencil-and-paper programs; this study added training based on a new-technology program. Moreover, the cognitive decline observed in the software group may suggest that the elderly performed worse in the posttest phase because of the

Table 2. Two factors (type of training and number of sessions) ANOVA for posttest dependent variables

Dependent variables	*df*	*F*	Sig.
RBMT	2	2.17	0.132
Total score	2	2.504	0.099
Delayed score	2	1.985	0.155
MFE	2	0.104	0.901
NHP	2	0.99	0.383

Note. Rivermead Behavioural Memory Test = RBMT; Memory Failures Everyday Life = MFE; Nottingham Health Profile = NHP; List of Associated Pairs = PAIRS.

Table 3. Improvement and reduction (−) in assessment performance after training (mean differences)

	RBMT		MFE		NHP		PAIRS	
Groups	≥38 sessions	<38 sessions	≥38 sessions	<38 sessions	≥38 sessions	<38 sessions	≥38 sessions	<38 sessions
Software	1.34*	−1.1	2.66	3.16	−1.92	0.33	−2.33	−4.33*
P&P	0.66	−1.34	8.83*	0.83	−2.0	3.16	−2.0	0.67
Mixed	−1.5	−1.0	7.33*	4.83	4.0*	2.47	0.33	2.16

*$p < .05$; Improvement &/or reduction = {Posttraining score = Pretraining score}; Rivermead Behavioural Memory Test = RBMT; Memory Failures Everyday Life = MFE; Nottingham Health Profile = NHP; List of Associated Pairs = PAIRS.

negative self-stereotypes in the use of computers (Boulton-Lewis, Buys, Lovie-Kitchin, Barnett, & David, 2007). These subjective variables are very important in designing longer programs.

Considering the subjective aspects measured in this study, both the pencil-and-paper ($Z = -2{,}003$; $p < .05$) and the mixed group ($Z = -2.023$; $p < .05$) improved their scores in the MFE when they received more than 38 sessions. The mixed group also improved its scores in the NHP scale ($Z = -1{,}997$; $p < .05$) in the posttest phase, although these results are not clearly stated in the literature (Ochoa,

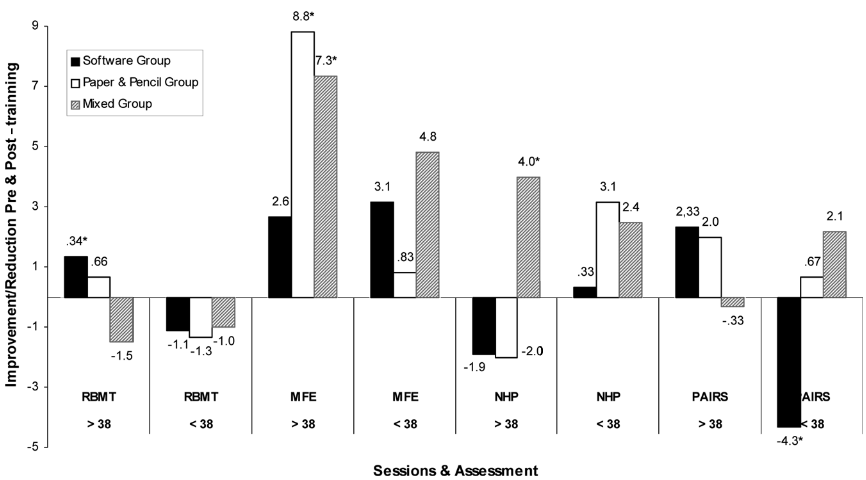

Figure 2. Pre- and posttraining improvement and/or reduction in assessment performance (mean differences) after training for all groups of participants. (Improvement &/or Reduction = {Posttraining score–Pretraining score}).

Aragon, & Caicedo, 2005). There does not seem to be a clearly demonstrable relation between objective and subjective memory aspects (Jungwirth et al., 2004). However, this study suggests that training objective memory could change subjective aspects that are not directly trained. Literature assumes that a small-group methodology (the pencil-and-paper and mixed group in this study) is better than individual methodology because participants can be aware of and correct their mistakes. Furthermore, participants have the opportunity of changing their experiences and helping each other. As a result, they feel better and improve their results in subjective memory and health (Martin & Zimprich, 2003).

This study can only validate the interaction between type of training and number of sessions when the List of Associated Pairs (Learning Score) is measured ($F = 5.69$; $p < 0.01$). The total mean is better in the posttest phase when participants receive ≥ 38 sessions (mean type of training and ≥ 38 sessions $= 17.33$; mean type of training and < 38 sessions $= 16$). These results seem to support the idea that any memory-or-cognitive training (i.e., traditional, multifactorial, or computer program) produces an improvement when the duration is appropriate (Stigsdotter-Neely, 2000; West, Welch, & Yassuda, 2000). Type of training effects were not significant on objective and subjective memory or health aspects. There is no evidence that a more traditional training (such as pencil-and paper) is better than a computer or multifactorial training. In addition, the correct number of sessions is not clear yet (Kapur et al., 2004; West, Welch, & Yassuda, 2000). But, according to the results, a larger number of sessions produced better objective (RBMT) and subjective (MFE) memory scores. Cognitive and memory plasticity in the elderly could be responsible for these results.

The present study has two limitations that may explain some of the unexpected results. The first one is that the sample was reduced to obtain statistically-significant results. Secondly, the software "How to Improve Your Mental Skills" did not directly train memory but rather attention and concentration. However, literature has established the importance of including attention activities in memory training (Kapur et al., 2004; Boman, Lindstedt, Hemmingsson, & Bartfai, 2004).

Because data suggest that memory training influences subjective aspects of memory and health, meta-memory aspects are an important issue for memory training programs. As a result, future research should improve the software program by including memory and meta-memory aspects, small group sessions, and activities adapted for a larger number of participants.

REFERENCES

Alonso, J., Anto, J. M., & Moreno, C. (1990). Spanish version of the Nottingham health profile: Translation and preliminary validity. *American Journal of Public Health*, *80*, 704–8.

Ball, K., Berch, D. B., Helmers, K. F., Jobe, J. B., Leveck, M. D., & Marsiske, M. et al. (2002). Effects of cognitive training interventions with older adults: A randomized controlled trial. *Jama*, *288*(18), 2271–2281.

Baltes, P. B., & Singer, T. (2001). Plasticity and the aging mind: An exemplar of the biocultural orchestration of brain and behavior. *European Review: Interdisciplinary Journal of the Academia Europaea*, *9*, 59–76.

Boman, I., Lindstedt, M., Hemmingsson, H., & Bartfai, A. (2004). Cognitive training in home environment. *Brain Injury*, *18*(10), 985–995.

Boulton-Lewis, G. M., Buys, L., Lovie-Kitchin, J., Barnett, K., & David, L. N. (2007). Ageing, learning, and computer technology in Australia. *Educational Gerontology*, *33*(3), 253–270.

Brehmer, Y., Li, S.-C., Straube, B., Stoll, G., von Oertzen, T., & Müller, V. et al. (2008). Comparing memory skill maintenance across the life span: Preservation in adults, increase in children. *Psychology and Aging*, *23*(2), 227–238.

Cadavid, C., & Dively, M. (2000). *Memoria 65+. Programa de mejora de la memoria en personas mayores*. [Memory 65+. Improving memory program for elderly people]. Madrid, Spain: Grupo Albor-Cohs.

Cavallini, E., Pagnin, A., & Vecchi, T. (2003). Aging and everyday memory: The beneficial effect of memory training. *Archives of Gerontology and Geriatrics*, *37*, 241–257.

Chasteen, A. L., & Bhattacharyya, S. (2005). How feelings of stereotype threat influence older adults' memory performance. *Experimental Aging Research*, *31*, 235–260.

Chen, S., Thomas, J., Glueckauf, R., & Bracy, O. (1997). The effectiveness of computer-assisted cognitive rehabilitation for persons with traumatic brain injury. *Brain Injury*, *11*, 197–209.

CogniFit. (2003). *Mindfit^{TM} Brain power fitness*. Santander, Spain: 2E Sistema Recomind.

Craik, F. I. M., & Bialystok, E. (2006). Cognition through the lifespan: Mechanisms of change. *Cognitive Sciences*, *10*(3), 131–137.

Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., & Rogers, W. A. et al. (2006). Factors predicting the use of technology: Findings from the center for research and education on aging and technology enhancement. *Psychology and Aging*, *21*(2), 333–352.

Desrichard, O., & Köpetz, C. (2005). A threat in the elder: The impact of task-instructions, self-efficacy and performance expectations on memory performance in the elderly. *European Journal of Social Psychology*, *35*, 537–552.

Economou, A., Simos, P. G., & Papanicolaou, A. C. (2006). Age-related memory decline. In A. C. Papanicolaou (Ed.), *The amnesias: A clinical textbook of memory disorders* (pp. 57–74). New York: Oxford University Press.

Fernández-Ballesteros, R. (2005). Evaluation of "vital aging-m:" A psychosocial program for promoting optimal aging. *Eurpean Psychologist*, *10*(2), 146–156.

Fernández-Ballesteros, R., Zamarrón, M. D., Tárraga, L., Moya, R., & Iñiguez, J. (2003). Cognitive platicity in healthy, mild cogntivie impairment (mci) subjects and alzheimer's disease patients: A research project in Spain. *European Psychologist*, *8*(3), 148–159.

Franco, M. A., Orihuela, T., Bueno, Y., & Cid, T. (2000). *Programa gradior: Programa de evaluación y rehabilitación cognitiva por ordenador.* [*Gradior*: *Assessment and rehabilitation computer software*]. Zamora, Spain: INTRAS.

Goldberg, D. P. (1972). *The detection of psychiatric illness by questionnaire*. London: Oxford University Press.

Gruber, T., & Müller, M. M. (2005). Induced gamma band responses in the human EEG: An early marker of implicit and explicit memory phenomena. *Journal of Psychophisiology*, *19*(2), 119–120.

Imserso. (2002). *Programa de entrenamiento en memoria. Cuaderno de ejercicios.* [*Training memory program*]. Madrid, Spain: Ministerio de Trabajo y Asuntos Sociales.

Jungwirth, S., Fischer, P., Wiessgram, S., Kirchmeyr, W., Bauer, P., & Tragl, K. (2004). Subjective memory complaints and objective memory impairment in the Vienna-Transdanube aging community. *Journal of the American Geriatrics Society*, *52*, 263–268.

Kapur, N., Glisky, E. L., & Wilson, B. A. (2004). External memory aids and computers in memory rehabilitation. In A. D. Baddeley, M. D. Kopelman & B. A. Wilson (Eds.), *The essential handbook of memory disorders for clinicians* (pp. 301–321). Chichester, UK: Wiley.

Kawashima, R. (2005). Train your brain: 60 days to a better brain. New York: Kumon.

Krampe, R. T., & Charness, N. (2006). Aging and expertise. In K. A. Ericsson, N. Charness, P. J. Feltovich & R. R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 723–42). New York: Cambridge University Press.

Levin, H. S. (2006). Neuroplasticity and brain imaging research: Implications for rehabilitation. *Archives of Physical Medicine and Rehabilitation*, *87*(12), 1–1.

Lobo, A., Escobar, U., & Gomez, F. (1979). El mini examen cognitivo: Un test sencillo, práctico para detectar alteraciones intelectivas en pacientes médicos. [Mini cognoscitive test. A easy assessment for detecting neurological injuries]. *Actas Luso-Españolas de Neuro Psiquiatria*, *3*, 189–202.

Maroto, M. A. (2002). *Taller de memoria. Cuaderno de tareas*. [Memory workshop. Activities notebook]. Madrid, Spain: Ediciones TEA.

Maroto, M. A. (2003). *Programa de estimulación y mantenimiento cogntivo.* [Stimulating and maintenance memory program]. Madrid, Spain: Instituto de Salud Pública.

Martin, M., & Zimprich, D. (2003). Are changes in cognitive functioning in older adults related to changes in subjective complaints? *Experimental Aging Research*, *29*, 335–352.

Mayhorn, C. B., Stronge, A. J., McLaughlin, A. C., & Rogers, W. A. (2004). Older adults, computer training, and the systems approach: A formula for success. *Educational Gerontology*, *30*(3), 185–203.

Montejo, P., Montenegro, M., Reinoso, A., De Andrés, M. E., & Claver, M. D. (1997). *Manual práctico de evaluación y entrenamiento de memoria. Método U.M.A.M.* [*UMAM Assessment and training practice handbook*]. Madrid, Spain: Unidad de Memoria. Área de Salud/Consumo del Ayuntamiento de Madrid.

Montejo, P., Montenegro, M., Reinoso, A. I., De Andrés, M. E., & Claver, M. D. (2001). Programas de entrenamiento de memoria. Método U.M.A.M. [UMAM Method. Assessment and training program]. *Cuadernos de Trabajo Social*, *14*, 255–278.

Navarro, J. I., Alcalde, C., Marchena, E., Ruiz, G., & Amar, R. (1996). Cómo mejorar tus habilidades mentales. (How to improve your mental skills). Cadiz, Spain: Departamento de Psicología de la Universidad de Cadiz [Department of Psychology University of Cadiz].

Ochoa, S., Aragón, L., & Caicedo, A. M. (2005). Memoria y metamemoria en adultos mayores: Estado de la cuestión. *Acta Colombiana de Psicología*, *14*, 19–32.

Park, D. C., & Minear, M. (2004). Cognitive aging: New directions for old theories. In R. A. Dixon, L. Bäckman & L.-G. Nilsson (Eds.), *New frontiers in cognitive aging* (pp. 19–39). New York: Oxford University Press.

Santrock, J. W. (2006). *Children*. NY: McGraw-Hill.

Saunders, E. J. (2004). Maximizing computer use among the elderly in rural senior centers. *Educational Gerontology*, *30*(7), 573–585.

Schmidt, I. W., Berg, I. J., & Deelman, B. G. (2001). Relations between subjective evaluations of memory and objective memory performance. *Perceptual and Motor Skills*, *93*, 761–776.

Singer, T., Verhaeghen, P., Ghisletta, P., Lindenberger, U., & Baltes, P. B. (2003). The fate of cognition in very old age: Six-year longitudinal findings in the Berlin aging study. *Psycholgy and Aging*, *18*(2), 318–331.

Skilbeck, C., & Roberston, I. (1992). Computer assistance in the management of memory and cognitive impairment. In B. A. Wilson & N. Moffat (Eds.), *Clinical management of memory problems* (2nd ed., pp. 154–188). London.

Stark-Wroblewski, K., Edelbaum, J. K., & Ryan, J. J. (2007). Senior citizens use e-mail. *Educational Gerontology*, *33*(4), 293–307.

Stigsdotter-Neely, A. (2000). Multifactorial memory training in normal aging: In search of memory improvement beyond the ordinary. In R. D. Hill, L. Bäkman & A. Stigsdotter-Neely (Eds.), *Cognitive rehabilitation in old age* (pp. 63–77). Oxford, UK: Oxford University Press.

Suderland, A., Harris, J. E., & Gleave, J. (1984). Memory failures in everyday life following severe head injury. *Journal of Clinical Neurology*, *6*, 127–142.

Sumic, A., Michael, I. L., Carlson, N. E., Howieson, D. B., & Kaye, J. A. (2007). Physical activity and the risk of dementia in oldest old. *Journal of Aging and Health*, *19*(2), 242–259.

Turvey, C. L., Schultz, S., Arndt, S., Wallace, R. B., & Hertzog, R. (2000). Memory complaint in a community sample aged 70 and older. *Journal of the American Geriatric Society*, *48*(11), 1435–1441.

Verhaeghen, P. (2000). The interplay of growth and decline. Theoretical and empirical aspects of plasticity of intellectual and memory performance in normal old age. In R. Bäckman & A. Stigsdotter-Neely (Eds.), *Cognitive rehabilitation in old age* (pp. 3–19). New York: Oxford Univesity Press.

Wadley, V. G., Benz, R. L., Ball, K. K., Roenker, D. L., Edwars, J. D., & Vance, D. E. (2006). Development and evaluation of home-based speed-of-processing training for older adults. *Archives of Physical Medicine and Rehabilitation*, *87*(6), 157–163.

West, R. L., Welch, D. C., & Yassuda, M. S. (2000). Innovative approaches to memory training for older adults. In R. D. Hill, L. Bäckman & A. S. Neely (Eds.), *Cognitive rehabilitation in old age* (pp. 81–97). Oxford, UK: Oxford University Press.

Wilson, B. A., Cockburn, J., & Baddeley, A. D. (1985). *The Rivermead behavioural memory test*. Titchfield, UK: Thames Valley Test Company.

Yang, L., Krampe, R. T., & Baltes, P. (2006). Basic forms of cognitive plasticity extended into the oldest-old: Retest learning, age, and cognitive functioning. *Psychology and Aging*, *21*(2), 372–378.

Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M., & Leirer, V. O. (1983). Development and validation of geriatric depression screening scale: A preliminary report. *Journal of Psychiatry Research*, *17*(1), 37–49.