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OLDER ADULTS' STRATEGIC BEHAVIOR: EFFECTS OF INDIVIDUAL VERSUS COLLABORATIVE COGNITIVE TRAINING

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Changes in strategic behavior were examined in older married couples participating in a cognitive intervention study. Participants were randomly assigned to: Questionnaire Control, Individual Training, or Collaborative Training. Trained participants completed inductive reasoning training sessions at home individually

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The training program used in the current study (Willis & Schaie, 1986, 1994) was most recently updated in the context of the ACTIVE clinical trial (Ball et al., 2002; Jobe et al., 2001).

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or as a couple. Participants were assessed at baseline, immediately following training, and a 3-month posttest. Overall, greater strategy use was related to higher ability performance across all groups. Collaborative and individual training groups showed a similar magnitude of strategy use at both posttests in terms of individual performance. Maintenance of strategy use on a collaborative task favored the collaborative group.

Poor cognitive functioning in later life has been identified as a major concern for older adults and their families as well as a significant public health issue. Ineffective use of relevant strategies has been implicated as a factor underlying age differences in cognitive performance. Effective use of relevant cognitive strategies, such as mnemonic and problem-solving approaches, has been associated with higher cognitive performance (Dunlosky & Hertzog, 2001, Saczynski, Willis, & Schaie, 2002). Research on expertise (Charness, 1981) shows that strategy use is associated with expert behavior and that older experts maintain use of relevant strategies and may compensate for reduced speed through strategic behavior (Salthouse, 1991). Moreover, cognitive training studies report associations between increased use of strategies and improvement on targeted abilities (Saczynski et al., 2002; Verhaeghen & Marcoen, 1996).

Prior research suggests that older adults tend to consistently use fewer and less effective strategies than younger adults. For example, Dunlosky and Hertzog (2001) report limited recall of paired associates by older adults when their strategies were self-generated compared to those in strategy instruction conditions. Additionally, when strategies are provided, older adults use less effective strategies than younger adults. Older adults also are less consistent across measures than younger adults in their use of strategies and may not transfer strategy use to a novel task (Devolder & Pressley, 1992). Within a training platform, old-old adults demonstrate less strategy acquisition compared to young-old adults (Saczynski, Willis, & Schaie, 2002), are less compliant with strategy instruction, and tend to apply strategies less effectively than younger adults (Verhaeghen & Marcoen, 1996).

The reduced use and acquisition of strategies with increasing age has led to two hypotheses regarding this phenomenon. The production deficiency hypothesis holds that although older adults are capable of using strategies, they are less likely to spontaneously produce or use effective strategies (Kausler, 1994). In contrast, the processing hypothesis states that some optimal strategies may be too complex and resource demanding, thus ineffectively used by older adults (Charness, 1981; Guttentag, 1985).

Although older adults generally tend to be deficient in strategy use, elders are able to acquire and effectively use strategies in specific situations. Descriptive studies provide evidence that older adults use strategies when cued to do so (Dunlosky & Hertzog, 2001; Dretzke, 1993), and cognitive training research on strategy use demonstrates immediate ability level intervention effects associated with greater strategic behavior with respect to memory (Verhaeghen & Marcoen, 1996) and inductive reasoning (Saczynski et al., 2002) performance. However, older adults do not tend to maintain strategy usage when the cue is removed or in long-term training follow-up (Camp, Markley, & Kramer, 1983; Scogin, Prohaska, & Weeks, 1998), thus the long-term benefit of cognitive strategy training is unclear.

The aim of the current study was to contribute to research on older adults' use of cognitive strategies in two respects. First, the study examined the efficacy of a self-directed training program in enhancing strategy use. Second, the study explored the utility of social support and collaborative learning in enhancing and maintaining strategic behavior for cognitive tasks. With regard to the first question, most studies demonstrating older adults' efficacious use of strategies have involved an external agent—either the researcher cuing strategy use or a trainer modeling strategy techniques. The question arose as to whether older adults could self-administer a training program that in prior research involved a trainer and resulted in increased strategy use and enhanced cognitive performance (Schaie & Willis, 1986; Saczynski et al., 2002). Successful acquisition of strategies and demonstration of an association between strategy use and cognitive improvement in a self-directed training program would address, in part, the processing hypothesis regarding the capability of older adults to use complex, resource-demanding strategies. We hypothesized that self-guided training would increase strategic behavior with effect sizes comparable to traditional, instructor-led training studies.

The second aim of the study drew on prior social support and collaborative learning literature to examine whether acquisition and maintenance of strategy use was improved in a collaborative context—compared to the traditional individual problem-solver approach (Craik, 1977; Kausler, 1994; Salthouse, 1991). There has been recent recognition in the gerontological literature of the role of social context, particularly social partners, in cognitive development and functioning in later life (e.g., Bckman & Dixon, 1992; Baltes & Staudinger, 1996; Meegan & Berg, 2002; Strough & Margrett, 2002). While intellectual ability has been studied traditionally at the level of the individual, much of cognitively demanding everyday problem solving occurs in a social context (Baltes, Maas, Wilms, Borchelt, & Little, 1999).

Social interactions may be one mechanism by which adults can maintain, enhance, and compensate for cognitive and functional deficits in later life (e.g., Bckman & Dixon, 1992; Baltes & Staudinger, 1996; Ferraro & Farmer, 1995; Marsiske, Lang, Baltes, & Baltes, 1995). Empirical work in the area of cognitive aging has demonstrated that older adults generally benefit from collaborating with others on varied cognitive tasks such as prose recall (e.g., Dixon & Gould, 1996), wisdom and social advice giving (Margrett & Marsiske, 2004; Staudinger & Baltes, 1996), errand-planning (Margrett & Marsiske, 2004), and comprehension of everyday printed materials such as medication labels and transportation schedules (Margrett & Marsiske, 2004). However, cognitive collaboration may serve numerous functions and may not always be beneficial (see Margrett, 1999). For example, collaboration with others has not proven advantageous under all circumstances (e.g., selected memory tasks: Andersson and Rnnberg, 1995, 1996; a route-planning task: Cheng, 2000; and pairings with unfamiliar partners: Gould, Kurzman, & Dixon, 1994; Gould, Trevithick, & Dixon, 1991). Indeed, the empirical work focusing on cognitive collaboration in later life is congruent with the broader literature on social support indicating that although social support may be generally positive or facilitative, negative or even detrimental effects are possible and the relationship between various facets of social support and particular outcomes is often complex (e.g., Finch, Okun, Pool, & Ruehlman, 1999; Rook, 1984; Stephens, Druley, & Zautra, 2002; Stephens, Kinney, Norris, & Ritchie, 1987).

Two findings from the prior literature on social collaboration are particularly relevant to the current study. First, social collaboration can be beneficial in more structured cognitive intervention situations (Blackburn, Papalia-Finlay, Foye, & Serlin, 1988). The structure of the training environment may provide a focus for collaborative activities and define the effort and time to be spent on various cognitive tasks. Second, findings from studies in other domains suggests that social support can enhance participation and adherence. For example, the exercise literature indicates that social support is related to engagement in an exercise routine (Resnick, Orwig, Magaziner, & Wynne, 2002) as well as adherence to fitness programs (Courneya & McAuley, 1995). The role of peer support in maintenance and adherence to an intervention is of particular relevance, given the prior findings that older adults' use of relevant strategies dissipates quickly in the absence of a trainer or cuing.

Due to the lack of research examining cognitive strategy usage and collaborative learning, comparisons of individual and collaborative learning in additional problem solving situations are needed. For example, older adults may evince differential benefit of strategy use training depending on whether they participated in training alone compared to training with a significant other. Additionally, it is possible that the facilitative effects of collaborative learning may occur (a) most strongly when performance is assessed in a collaborative context (as compared to an individual assessment) and (b) may evince a different trajectory of effects over time compared to individual learning (i.e., short- and long-term effects may vary across learning contexts). We hypothesized that collaboratively trained participants would show gains in strategic behavior similar to that exhibited by individually trained participants on the individually performed reasoning tasks; however, collaborative trainees were expected to demonstrate greater gains on the collaboratively performed tasks. We also hypothesized that collaborative training might be related to enhanced retention of strategic behaviors due to the fact that couples in this group completed training together and might subsequently reinforce maintenance of these behaviors.

Much of the prior training research on strategy use has focused on memory ability (Camp, Markley, & Kramer, 1983; Hertzog, McGuire, & Lineweaver, 1998; Verhaghen & Marcoen, 1996). In the current study, inductive reasoning ability is the target of training. Similar to memory training protocols, training on reasoning ability has focused on the acquisition of strategies specific to reasoning ability (Saczynski et al., 2002). However, virtually all prior training on reasoning ability has been trainer-directed, and thus there is limited study of older adults' ability to self-administer reasoning training procedures. Inductive reasoning ability has been shown to be highly related to working memory (Salthouse, 1991) and to executive functioning (Lezak, 1995). In addition, level of reasoning ability has predicted competence in everyday tasks over a seven-year interval in nondemented elders (Willis, Jay, Diehl, & Marsiske, 1992) and has been associated with level of functioning in demented elderly (Willis, Dolan, & Bertrand, 1998).

THE CURRENT STUDY

The following three questions relating to strategy usage in inductive reasoning training were addressed in this study: (1) Does strategy use, indicated by pattern markings on three inductive reasoning ability measures, differ across training conditions from pretest to immediate and delayed follow-up? (2) What participant characteristics are associated with change in strategy use over the immediate and delayed follow-up intervals? (3) Is strategy usage associated with training gain on the reasoning measures? In the current context, these questions are important in several respects. First, the findings can address the effectiveness of the self-administered training approach (i.e., participants learned the strategic behaviors emphasized in training and were subsequently able to demonstrate this behavior). Second, comparison of individual and collaborative learning within a structured learning environment provides information on the relative efficacy of the two training procedures. Findings on both self-administered and collaborative learning may contribute to development of more contextually-based training procedures.

METHOD

Participants

The sample included 48 older married couples ($N = 95$ individuals and 47 dyads with complete data) from central Pennsylvania. Participants were community-dwelling couples, with no reported limitations in self-care activities, who had been legally married for 15 or more years to their current spouse and were not in a marital caregiving relationship. Complete data are available on 95 individuals. The mean age of the sample was 71.6 years ($SD = 5.8$; range = 61–89) and participants had been married an average of 47 years ($SD = 8.2$; range = 15–61). The average educational level of the total sample was 16.0 years ($SD = 3.1$ range = 12–23) with 75% of participants reporting an educational level of 12 years or more. The median yearly income was $47,644 (range = $18,000–$50,000+).

Couples were randomly assigned to one of three groups (Questionnaire Only, $n = 31$ individuals; Individual Training, $n = 32$; Collaborative Training, $n = 32$). Training groups were examined for possible differences in age, education, pretest reasoning ability performance (Letter Series Test; Blieszner, Willis, & Bulks, 1981), and pretest strategy usage. Analysis of variance results did not reveal any significant differences between participants in the three conditions.

MEASURES

Inductive Reasoning Measures

Inductive reasoning reflects the ability to infer general principles from specific instances and apply these general principles to new instances of the problem. Inductive reasoning is highly related to working memory (Salthouse, 1991) and to components of executive functioning

(Lezak, 1995). Three measures were administered to assess participants' inductive reasoning performance at the pretest and immediate and delayed posttest sessions. Accuracy scores were calculated for all reasoning measures by dividing the number of items correctly answered by the total number of items attempted (i.e., sum of items answered correctly, incorrectly, and omitted). These three reasoning tasks were chosen as they provide direct tests of the training effects, with the Letter Series Test being most reflective of concepts emphasized and practiced during training.

Letter Series Test

The Letter Series Test (Blieszner, Willis, & Baltes, 1981) is a 20-item measure that assesses respondents' ability to identify the pattern in a series of letters and to generate the next letter in each series. Series ranged from 7 to 15 letters ($\alpha = .91$; Blieszner et al., 1981). Respondents completed as many items as possible in a four and one-half minute period.

Word Series Test

The Word Series Test (Schaie, 1985) is a 30-item test that requires participants to identify the pattern in a vertical series of related words (e.g., days of the week, months of the year) and to produce the next word in the series. Participants completed as many items as possible in six minutes.

Letter Sets Test

The Letter Sets (Ekstrom, French, Harman, & Dermen, 1976) is a 15-item test that requires respondents to examine five sets of letters, identify a pattern, and decide which set of letters does not follow the same pattern as the other four sets presented ($\alpha = .74$–84; Ekstrom et al., 1976). The test administration was modified in the current study such that it was completed by each couple, rather than by individuals; thus the reported score is for the couple. Couples completed as many items as possible in seven minutes.

Demographics

Participants completed a paper-and-pencil measure assessing demographic information as well as their self-reported ratings on several dimensions including physical and mental health and life satisfaction.

PROCEDURE

Couples were recruited and screened for eligibility during a brief phone interview. Screening criteria were: (1) 60 years of age or older; (2) No limitations in activities of daily living or mental impairment, to eliminate or reduce caregiving roles in couples; and (3) Married at least 15 years, to ensure well-established marital interaction patterns (e.g., Carstensen, Levenson, & Gottman, 1995). Participating couples received a small honorarium (i.e., $40 for the two training groups and $20 for the non-training group). Couples were randomly assigned to one of three conditions: (1) Questionnaire Only (control) group (2) Individual Training group, and (3) Collaborative Training group.

Baseline Pretest and Posttest Assessments

All participants completed a three-hour group pretest assessment during which demographic and inductive reasoning measures were administered. Participants completed the Letter and Word Series Tests individually, and completed the Letter Sets Test with their spouse. Participants completed a two-hour Immediate Posttest group session within one week of the final training session (approximately six weeks after the initial pretest session) and an analogous Delayed Posttest group session (approximately 18 weeks after the initial pretest session). Additional details are available in Margrett and Willis (2004).

Inductive Reasoning Training Protocol

The inductive reasoning materials used in this study have been used in prior training studies (e.g., Ball et al., 2002; Willis & Schaie, 1986, 1994) to train either individuals or groups of participants in the use of strategies instrumental in identifying the patterns in inductive reasoning items. There were ten training sessions for the Individual and Collaborative conditions. Training was conducted over a four- to five-week period. Each training session involved two major sections. One section focused on practicing basic series problems and learning strategies to solve reasoning problems. Participants were sequentially introduced to five strategies for solving basic series problems, including visual scanning of the item, saying the item aloud in order to hear the pattern, underlining repeated elements in the series, inserting slashes between patterns and repetitions, and placing tick marks above each skip in a pattern. The second section of each session focused on practical exercises involving printed stimuli from everyday tasks and the application of strategies to this material.

Couples completed the training materials in their home. Husbands and wives assigned to the Individual condition completed the sessions alone and were instructed not to discuss the training with each other. Participants in the Collaborative condition were instructed to work with their spouse on the training session materials. At the end of each session trainees completed a timed assessment of individual inductive reasoning performance. Each session was designed to be completed in 60 to 75 minutes. After completion of each session, participants placed their completed material in a sealed envelope. Participants were encouraged to contact a researcher at any time with questions.

Strategy Usage Coding

Participants' Pretest, Immediate Posttest, and Delayed Posttest materials for the Letter Series, Letter Sets, and Word Series Tests were coded for strategy use. Four strategies were coded: (1) slashes between elements in repetitions of patterns; (2) tick marks between skipped letters or words; (3) underlining of repeated letters/words in a series; and (4) other strategies not categorized as examples of the first three (Saczynski et al., 2002). To ensure reliability, a minimum of two "strategy marks" was required in order for an item to be scored as exhibiting any strategy use. The two required markings could represent two instances of the same marking (e.g., two underlines indicating repeated letters) or two different strategies (e.g., a tick and a slash). In order to identify strategy use on the measures of inductive reasoning, trained coders followed strict guidelines for the coding procedure. Coders were blinded as to the training group of the participant. Inter-rater reliability (Kappa) was assessed on 5% of the protocols and was found to be .88 (mean across times of measurements and reasoning tests).

Each *item* was coded "0" or "1" designating whether or not strategy use was indicated. Total strategy use scores were calculated separately for each of the three reasoning measures by summing the number of individual items on which strategy use was indicated. Thus, strategy usage scores represent the total number of items for each measure in which strategy use was exhibited, irrespective of the frequency of demonstrated strategic behaviors within each item.

RESULTS

The results addressed two primary research questions: (1) Does strategy usage differ across training conditions, reasoning measures, or assessment occasions? and (2) Is greater strategy usage associated with increased accuracy on the three reasoning measures after the training period? In addition, the analyses address the relation of participant age, gender, and education to gain in strategy use and post-training accuracy. Results are reported for two assessment intervals: (1) Pretest to Immediate Posttest, and (2) Pretest to Delayed Posttest (three months after initial training).

Change in Strategy Use: Treatment Effects and Demographic Variables

To address the first research question, a series of repeated measures analysis of covariance (ANCOVA) tests were performed to investigate the associations among training condition, age, gender, education, and change in strategy use on the three reasoning measures over the pretest to immediate and delayed posttest intervals. Specifically, a series of 2 occasion (Pretest, Immediate/Delayed Posttest) × 3 training condition (Questionnaire Only, Individual Training, Collaborative Training) × 2 gender (Male, Female) × 2 age group (median split, Young Old: 61–71 years, Old-Old: 72–89 years) ANCOVAs were conducted. Education was entered as a covariate. The dependent variables were Pretest and Immediate/Delayed Posttest strategy use scores on each of the three reasoning measures. Table 1 presents information regarding the average number of items on which strategies were used, presented by treatment group, age, and gender at pretest, immediate posttest and delayed posttest for the three reasoning measures. Means presented below for each ANOCVA model are the least square means adjusting for the main effects of the ANCOVA models and thus do not reflect the raw means presented in Table 1.

Change in Strategy Use: Pretest to Immediate Posttest

Letter Series

A significant occasion × training group interaction [F (2, 82) = 53.63, MS_e = 356.00, $p < .001$] indicated that change in strategy use varied significantly (reliably) between the three conditions. Follow-up analyses revealed that strategy use gain for both intervention conditions (Individual Training, Collaborative Training) differed significantly from the Questionnaire Only condition [F (1) = 90.34, $p < .001$; Pretest–Posttest adjusted mean gain: Individual = 8.95 items; Collaborative = 7.54 items; Questionnaire Only group = −0.09 items]. Change in strategy use did not differ between the two intervention groups. All higher order interactions were non-significant and results were not affected by educational level, age, or gender. Main effects for all variables except training group were non-significant (data not shown).

Word Series

A significant occasion × training group interaction [F (2, 82) = 19.24, MS_e = 387.4, $p < .001$] indicated that change in strategy use varied across the three training conditions. Similar to findings for Letter Series, follow-up analyses revealed that strategy use gain in both intervention conditions (Individual Training, Collaborative Training) differed significantly from the Questionnaire Only condition [F (1) = 38.42, $p < .001$; Pretest–Posttest adjusted mean gain: Individual = 9.21 items; Collaborative = 8.64 items; Questionnaire Only group = −0.04 items]. Change in strategy usage from pretest to immediate posttest did not differ between the two training conditions. All higher order interactions were non-significant and effects were not affected by education level. Main effects for all variables except training group status were non-significant (data not shown).

Letter Sets

The Letter Sets measure was performed collaboratively by each couple yielding a single score. Analyses were conducted with age and education representing the couple average. Gender was not examined because each couple produced one score. Results were consistent with findings on the other two reasoning measures. A significant occasion × training condition interaction [F (2, 40) = 11.94, MS_e = 29.9, $p < .001$] indicated that pretest to immediate posttest strategy use gain differed between the three conditions. Post hoc analyses revealed that although there were no significant differences in strategy use gain between the two intervention conditions, participants in an intervention condition showed significantly greater mean pretest to posttest gain [F (1) = 22.14, $p < .001$; Pretest–Posttest adjusted mean gain: Individual: 2.63 items; Collaborative: 2.87 items] than did the Questionnaire Only group (−0.21 items). All higher order interactions were non-significant. Strategy use gain did not vary by average couple age, and results were not affected by education level. Main effects were non-significant with the exception of training group membership (data not shown).

Change in Strategy Use: Pretest to Delayed Posttest

Letter Series

A significant occasion × training group interaction [F (2, 82) = 11.79, MS_e = 101.9, $p < .001$] indicated that the Pretest to Delayed Posttest

TABLE 1 Item Unadjusted Means and Standard Deviations for Strategy Use on the Letter Series ($N = 95$ Individuals), Word Series ($N = 95$ Individuals), and Letter Sets ($N = 47$ Dyads) Tests

	Letter series strategy use			Word series strategy use			Letter sets strategy use		
	pretest *M* (*SD*)	Immediate posttest *M* (*SD*)	Delayed posttest *M* (*SD*)	pretest *M* (*SD*)	Immediate posttest *M* (*SD*)	Delayed posttest *M* (*SD*)	pretest *M* (*SD*)	Immediate posttest *M* (*SD*)	Delayed posttest *M* (*SD*)
Collaborative training									
Total	0.34 (0.90)	7.62 (4.54)	4.90 (5.15)	0.87 (2.90)	9.31 (8.16)	6.09 (7.48)	1.00 (1.72)	3.93 (4.54)	3.50 (3.90)
Gender									
Female	0.06 (0.25)	7.62 (4.78)	4.81 (4.63)	0.75 (2.26)	8.50 (7.29)	5.37 (7.44)	—	—	—
Male	0.62 (1.20)	7.62 (4.44)	5.00 (5.77)	1.00 (3.50)	10.12 (6.18)	6.81 (7.69)	—	—	—
Couple	—	—	—	—	—	—	1.00 (1.75)	3.93 (2.74)	3.50 (3.96)
Age									
Young-old	0.71 (1.26)	8.42 (3.91)	7.42 (5.93)	1.92 (4.23)	11.42 (7.36)	8.36 (8.04)	1.64 (2.16)	5.14 (1.87)	5.86 (4.17)
Old-old	0.06 (0.24)	7.00 (4.99)	2.94 (3.48)	0.05 (0.23)	7.66 (8.58)	4.33 (6.72)	0.50 (1.10)	3.00 (2.91)	1.66 (2.52)
Individual training									
Total	0.28 (1.25)	9.47 (4.31)	5.34 (5.74)	0.34 (1.77)	9.86 (7.41)	6.34 (6.22)	0.53 (1.52)	3.96 (2.74)	2.60 (2.82)
Sex									
Female	0.12 (0.34)	8.93 (4.05)	4.56 (5.30)	0.06 (0.25)	7.57 (7.47)	4.56 (5.89)	—	—	—
Male	0.44 (1.75)	10.00 (4.61)	6.12 (6.22)	0.62 (2.50)	12.00 (6.91)	8.12 (6.21)	—	—	—
Couple	—	—	—	—	—	—	0.50 (1.50)	4.18 (2.61)	2.68 (2.84)
Individual training									
Age									
Young-old	0.00 —	10.11 (4.62)	5.94 (6.49)	0.00 —	10.61 (7.97)	5.38 (6.05)	0.11 (0.32)	3.55 (1.91)	1.83 (1.68)
Old-old	0.64 (1.86)	8.64 (3.87)	4.57 (4.73)	0.78 (2.66)	8.63 (6.54)	7.57 (6.44)	1.00 (2.14)	4.64 (3.38)	3.50 (3.69)
Questionnaire only									
Total	0.23 (0.61)	0.06 (0.25)	0.45 (1.06)	0.35 (0.91)	0.22 (1.25)	0.61 (2.41)	0.81 (1.19)	0.61 (1.43)	0.55 (0.85)
Gender									
Female	0.21 (0.80)	0.00 —	0.42 (1.34)	0.42 (1.15)	0.50 (1.87)	0.92 (3.47)	—	—	—
Male	0.23 (0.43)	0.11 (0.33)	0.47 (0.79)	0.29 (0.68)	0.00 —	0.35 (0.99)	—	—	—
Couple	—	—	—	—	—	—	0.64 (1.00)	0.57 (1.50)	0.42 (1.34)
Age									
Young-old	0.36 (0.80)	0.06 (0.25)	0.68 (1.35)	0.56 (1.15)	0.44 (1.75)	1.18 (3.31)	1.00 (1.36)	0.81 (1.72)	0.62 (0.95)
Old-old	0.07 (0.26)	0.06 (0.26)	0.20 (0.56)	0.13 (0.51)	0.00 —	0.00 —	0.60 (0.98)	0.40 (1.05)	0.47 (0.74)

Note. Couple means are reported for Letter Sets Test rather than by gender because each couple performed the Letter Sets task together and produced a single product. Couple means are blank for Word Series and Letter Series tests because couples performed these tests individually. Age: Young-Old (61–71 years) $n = 50$, Old-Old (72–89 years) $n = 45$.

change in strategy use differed between the three conditions. Similar to immediate posttest findings, long term gain in strategy use was similar in the two intervention conditions (Individual Training, Collaborative Training). Participants who were trained showed significantly greater long term gain in strategy use from Pretest to Delayed Posttest [F (1) = 18.77, $p < .001$; Pretest–Posttest adjusted mean gain: Individual: 4.77 items; Collaborative: 4.92 items] than did the Questionnaire Only group (0.30 items). A significant occasion × age interaction indicated that young-old participants showed significantly [F (1, 82) = 4.69, $MS_e = 40.5$, $p < .05$] greater long term gain in strategy usage over the Pretest to Delayed Posttest interval across treatment conditions compared to older participants [Pretest–Delayed Posttest adjusted mean gain: Young-Old = 4.29 items; Old-Old = 2.37 items]. Change in strategy use on the Letter Series measure did not differ by gender. All higher order interactions were non-significant and results were not affected by education. Main effects were non-significant for all variables except training group (data not shown).

Word Series

A significant occasion × training condition interaction [F (2, 82) = 9.66, $MS_e = 150.0$, $p < .001$] indicated that long-term change in strategy use differed in the three conditions with participants in both training groups showing significantly greater gain in strategy use over the delayed follow-up interval [F (1) = 16.99, $p < .001$; Pretest–Delayed Posttest adjusted mean gain: Individual: 5.80 items; Collaborative: 5.51 items] than did participants in the Questionnaire Only group (0.33 items). Change in strategy use did not differ by age group or gender and all higher order interactions were non-significant. Results were not affected by education. Main effects were significant for training group only (data not shown).

Letter Sets

A significant occasion × training condition interaction [F (2, 40) = 14.37, $MS_e = 27.9$, $p < .001$] indicated that change in strategy use differed among the three conditions. Couples in both training conditions showed significantly greater gain in strategy use [F (1) = 25.26, $p < .001$; Pretest–Delayed Posttest adjusted mean gain: Individual: 2.14 items; Collaborative: 2.97 items] than the Questionnaire Only group (−0.12 items). Moreover, there was a significant difference in long-term strategy use gain by training condition [F (1) = 4.18, $p < .05$]. Couples in the Collaborative Training condition exhibited significantly greater gain in strategy use over the delayed follow-up interval than couples in the individual training condition (Adjusted mean gain: Individual = 1.92 items, Collaborative = 3.42 items).

A significant occasion × training group × age interaction [F (2, 82) = 7.79, $MS_e = 15.2$, $p < .01$] revealed differences in maintenance of strategy use in the younger members of the collaborative training group. Younger couples in the Collaborative condition showed greater gain in long-term strategy use compared to older couples in the Collaborative Training condition (Adjusted mean gain: younger = 5.85, older = 1.03) and both younger and older couples in the Individual Training (Adjusted mean gain: younger = 1.72, older = 2.13) as well as participants in the Questionnaire Only conditions (Adjusted mean gain: younger = −0.56, older = −0.16). All other higher order interactions were non-significant and education did not affect results. Main effects were significant for training group and age only (data not shown).

Strategy Use and Training Gain

Multiple regression analysis was used to examine the second primary research question. These analyses investigate the relationship between posttest strategy use and gain in accuracy on the Letter Series, Word Series, and Letter Sets measures across the two assessment intervals: Pretest to Immediate Posttest and Pretest to Delayed Posttest. Immediate and delayed accuracy of performance (ratio of the number of items answered correctly to the total number of items attempted) on each of the reasoning measures served as the dependent variables. Independent variables included: pretest accuracy, posttest strategy use on the target reasoning measure, training condition, the interaction between posttest strategy use and training condition, age, and education. Gender was included as an independent variable in Letter Series and Word Series models but excluded from Letter Sets models because the task was performed collaboratively by the couple resulting in a single dyadic score. Results are presented separately for each measure, first examining the immediate training interval (Pretest to Immediate Posttest) and then the delayed interval (Pretest to Delayed Posttest).

Strategy Use and Immediate Training Gains

For all three reasoning measures, higher pretest performance ($p < .001$) and greater strategy use ($p < .05$) at immediate posttest were significantly associated with greater accuracy at immediate posttest (Tables 2–4). Reasoning performance did not vary by training group status after accounting for pretest accuracy and strategy use. Thus

TABLE 2 Multiple Regression Results Examining Letter Series Training Gain over the Pretest to Immediate Posttest Interval ($N = 95$ Individuals) and Pretest to Delayed Posttest Interval ($N = 95$ Individuals)

	Pretest–immediate posttest			Pretest–delayed posttest		
Predictors	β	B	SE	β	B	SE
Pretest letter series accuracy	.45***	.38	.07	.45***	.41	.09
Posttest strategy use	.29*	.01	.01	.30*	.01	.01
Training group	.20	.04	.04	.24	.06	.05
Training group* strategy use	.11	.02	.03	−.25	−.04	.04
Age	.05	.01	.01	−.01	−.01	.01
Gender	.16	.06	.03	.10	.04	.04
Education	.12	.01	.01	.11	.01	.01
R^2		.56			.37	

*$p < .05$; **$p < .01$; ***$p < .001$.

although strategy use was associated with reasoning performance at immediate posttest, the relationship between strategic behavior and accuracy did not vary between the training conditions, even for the collaboratively performed reasoning task (Letter Sets). Age and education were not significantly related to accuracy on all three reasoning

TABLE 3 Multiple Regression Results Examining Word Series Training Gain over the Pretest to Immediate Posttest Interval ($N = 95$ Individuals) and Pretest to Delayed Posttest Interval ($N = 95$ Individuals)

	Pretest–immediate posttest			Pretest–delayed posttest		
Predictors	β	B	SE	β	B	SE
Pretest word series accuracy	.53***	.47	.09	.32**	.23	.07
Posttest strategy use	.77*	.01	.01	.77	.01	.01
Training group	.22	.04	.02	.37	.05	.02
Training group* strategy use	−.71	−.01	.01	−.91	−.01	.01
Age	.10	.01	.01	.10	.01	.01
Gender	.06	.03	.03	.24*	.06	.02
Education	.06	.01	.01	.15	.01	.01
R^2		0.37			0.29	

*$p < .05$; **$p < .01$; ***$p < .001$.

TABLE 4 Multiple Regression Results Examining Letter Sets Training Gain over the Pretest to Immediate Posttest Interval ($N = 47$ Dyads) and Pretest to Delayed Posttest Interval ($N = 47$ Dyads)

	Pretest–immediate posttest			Pretest–delayed posttest		
Predictors	β	B	SE	β	B	SE
Pretest letter sets accuracy	.43**	.26	.09	.44**	.30	.29
Posttest strategy use	.98*	.03	.02	1.01*	.05	.10
Training group	.26	.03	.02	.08	.01	.03
Training group* strategy use	−.85	−.01	.01	−.99	−.02	.01
Age	.05	.01	.01	.07	.01	.01
Education	.01	.01	.01	−.19	−.01	.01
R^2		.33			.30	

*$p < .05$; **$p < .01$; ***$p < .001$.

Note: Gender was not included in this model because the measure was performed collaboratively by the dyad, thus generating a single outcome score.

measures and gender was not related to accuracy on the Letter Series or Word Series measures.

Strategy Use and Maintenance of Training Gain

Accuracy gain on the three reasoning measures at the delayed follow-up (three months following training) was examined. For Letter Series and Letter Sets, higher pretest performance (Letter Series: $p < .001$, Letter Sets: $p < .01$) and greater strategy use at the delayed follow-up ($p < .05$) were associated with higher maintenance of accuracy over the three-month delay (Tables 2 & 4). For these two measures, training group status and demographic variables were not related to accuracy and strategy use was not differentially associated with performance by training group status.

For Word Series, only higher pretest performance ($p < .001$) and gender ($p < .05$), favoring women, were related to maintenance of accuracy (Table 3). Strategy use, training group membership, and demographic variables were not associated with accuracy gain following the delayed interval.

DISCUSSION

This study examined changes in strategy use in response to either an individual or collaborative behavioral intervention. Several key findings relevant to cognitive aging and collaborative learning were identified. First, findings suggest that inductive reasoning training was related to significant gains in strategic behavior for both the individual and collaborative training groups on assessments completed both individually and with one's spouse. These findings extend the strategy acquisition and usage literature to include results from a collaborative learning context by comparing individual and collaborative learning effects. Furthermore, strategic behavior did not dissipate following the intervention period and the relationship between strategy usage and ability level performance was maintained three months after the completion of the training program. A second set of findings suggests that strategy usage following intervention was related to higher ability performance in both the individual and collaborative training groups.

STRATEGIC BEHAVIOR: INDIVIDUAL VERSUS COLLABORATIVE CONTEXTS

A main objective of this study was to determine if strategy acquisition or maintenance differs by training group status (i.e., Questionnaire Only, Individual Training, Collaborative Training) on measures completed individually or jointly with a spouse. Participants' strategy use increased in both training conditions over the immediate follow-up period on all reasoning measures. No differences in strategy use gains were identified between the two training groups at the immediate posttest. Additionally, effect sizes were similar for collaboratively and individually trained participants on the individual and collaborative reasoning measures [(Individual Tasks—Letter Series effect sizes: Collaborative = .74, Individual = .82; Word Series effect sizes: Collaborative = .39, Individual = .60) (Collaborative task—Letter Sets effect sizes: Collaborative = .56, Individual = .66)] suggesting that strategy effects were not specific to the training context. Individuals trained collaboratively showed immediate gains in both individual and collaborative problem solving contexts.

There was evidence suggesting that collaboratively trained participants demonstrated better maintenance of strategy use when assessed in the collaborative problem solving context at the three-month follow-up. Prior work has noted that although strategy gains are typically observed immediately following individual training or cueing, strategy usage dissipates over time with the removal of training or cues (Camp, Markley, & Kramer, 1987; Scogin, Prohaska, & Weeks, 1998). Maintenance of strategy use on individually completed reasoning tasks did not differ by training condition (individual, collaborative) while strategy usage on the collaborative task was only maintained when learning occurred in a collaborative context. Thus, collaborative learning appears to partially alleviate the dissipation of training effects observed once the intervention period is complete, but only in the collaborative context in which they were learned. In contrast, strategy usage on individually performed tests was maintained in trained participants across the two learning contexts (i.e., Individual Training, Collaborative Training), indicating that collaborative learning did not impede (or enhance) performance on an individual task.

Although there were few differences between the training groups in strategy acquisition and usage, it is significant that collaborative learning maximized the maintenance of strategic behavior only on the collaboratively performed task. These findings have implications for abilities that are targeted for intervention and the intervention conditions. Strategies for performing collaborative tasks may benefit maximally from training in a dyadic or group setting rather than an individual training situation. Additionally, both participants in collaboratively trained dyads showed strategy gains on individually performed tasks, suggesting that both partners benefit in a collaborative learning context. Self-guided strategy training conducted individually or collaboratively appears to partially alleviate the production deficiency constraining participants at pretest. Collaborative training seems to additionally impact the processing deficiency when problem solving is conducted in a collaborative context.

The results suggest that the benefits of collaborative learning may become more evident in delayed follow-ups. Initial training gains in strategic behavior did not differ between the two training conditions in the current study; perhaps the collaborative training group was more likely to apply their training to everyday life and/or participated in more ongoing, lasting practice and reinforcement with their spouse compared to the individual trainees who learned alone. Additional research is needed to compare individual and collaborative learning within the training situation, as well as the subsequent extension of training to everyday contexts.

STRATEGY USAGE: RELATION TO OUTCOME AND TRAINING CONDITION

Our findings are consistent with previous work on the association between strategic behavior and individual cognitive training gains in older adults (Saczynski et al., 2002; Verhaeghen & Marcoen, 1996) and extend these findings to collaborative learning and problem solving contexts. Additionally, we found maintenance of performance across groups over a three-month interval on individual and collaborative reasoning tasks related to strategy use. However, we did not find differences between training groups in maintenance after accounting for strategy usage. Dissipation of trained strategies following intervention may contribute to inconsistent findings on the maintenance of behavioral intervention effects (Blieszner et al., 1981; Willis & Nesselroade, 1990).

Strategy acquisition and usage did not differ significantly between reasoning training conditions with the significant exception of long-term gain on the Letter Sets measure. Previous work on the relationship between strategy use and training gains has focused almost exclusively on traditional classroom training or experimental cueing designs (Dretzke, 1993; Dunlosky & Hertzog, 2001; Saczynski et al., 2002; Verhaeghen & Marcoen, 1996). Our findings extend this work to self-administered and collaborative training conditions. Strategy acquisition was of a similar magnitude to that of training studies within the Seattle Longitudinal Study (SLS effect sizes: Letter Series = .59, Word Series = .37; Saczynski et al., 2002), which employed a one-to-one trainer to participant ratio. These findings indicate that optimal strategies can be acquired through self-guided training conditions and carry important implications for the generalizability and large-scale dissemination of cognitive training programs. Additional research is needed to further investigate the optimal conditions for training that can facilitate maintenance of learned strategies and material.

The findings on the utility of self-guided and collaborative training procedures on an ability such as inductive reasoning ability are relevant to future directions in intervention research and e-learning for older adults (Willis, in press). Future generations of elderly are likely to engage in learning activities over the Internet or through virtual classrooms. The current study supports the ability of elderly to self-direct their learning activities and to develop the necessary strategies critical to such learning enterprises. Given the findings of prior research on the association of reasoning ability to critical cognitive processes such as working memory, executive functioning, and everyday tasks, these findings on the efficacy of self-guided and collaboratorative learning are particularly useful.

There are several limitations of the current study. First, it is important to note that participants in this study were highly educated and reported relatively high income levels. Additionally, all participants were living independently and had a healthy spouse who also was able to participate in the study. Thus, the sample consisted of community dwelling adults who were relatively healthy and are comparable to many cognitive intervention samples, permitting generalizability of findings. Although some efforts have been made to cognitively train older adults who have experienced pathological decline (Camp, Cohen-Mansfield, & Capezuti, 2002), we do not propose that the self-directed training involved in our study would be appropriate with such a population. Second, in the present study we do not compare self-guided training to a traditional trainer-led training condition to determine differences by training condition. However, as mentioned earlier effect sizes for strategy gains are similar to those reported in the Seattle Longitudinal Study (Saczynski et al., 2002) where reasoning training was trainer-led and conducted on a one-on-one basis. In the current study, partner relationship (i.e., long-term married couples) was held constant in this study, however, factors such as relationship type, quality, and duration are likely to be important components of collaborative learning (e.g., Gould, Kurzman, & Dixon, 1994; Margrett & Marsiske, 2002) and should be addressed. Additionally, transfer of training effects to other cognitive measures and elders' everyday functioning merits further study. Within the present study, we will be able to address some of these concerns in future analyses.

CONCLUSION

This study examined the frequency of strategic behavior following a behavioral intervention and the relationship between strategy usage and reasoning performance. The study findings lend further support to the growing literature on strategy use as a mechanism of cognitive training gains in later life. Increases in strategy use and in corresponding ability performance following behavioral intervention, which were observed in the current study, support work examining the plasticity of cognitive ability in adulthood and extend traditional intervention study findings to novel training platforms (i.e., trainer-less sessions, collaborative training). Results from this study and other behavioral interventions suggest that various types of cognitive interventions have the potential to enhance cognitive performance through increased strategy usage. Additional research is needed to determine any possible added benefits of collaborative learning contexts in relation to structured cognitive interventions and subsequent extension to older adults' daily lives.

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RESILIENCY AND SPIRITUALITY: FOUNDATIONS OF STRENGTHS PERSPECTIVE COUNSELING WITH THE ELDERLY

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Old age is characterized as a period of resiliency when the older person uses internal and external resources to overcome the challenges presented by this stage of life. By acknowledging older adults' resiliency and spiritual resources in light of past and present risk factors, care providers can focus on capabilities, assets, and positive attributes rather than problems and pathologies. This paper presents a conceptual and practical framework for teaching strengths perspective counseling for older clients in which resiliency and spirituality best describe the application or operationalization of strengths.

Old age is a challenging period in people's lives that often include sudden and multiple losses and unforeseen physical, emotional, social, and spiritual assaults to their person. Conventional gerontological assessments collect deficit-focused data such as an older person's dependencies, disabilities, risk factors for nursing home placement, available informal support, and so forth. Assessments within the traditional medical model fail to provide a language with which to discuss client strengths, a conceptual framework within which to build strengths, or tools for evaluating the outcomes of interventions intended to promote strengths. The administration of these inventories is time consuming for both practitioners and clients. For example, completion of the Resident Assessment Instrument takes five

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