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**Title:** The role of cognitive flexibility in cognitive restructuring skill acquisition among older adults

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Abstract

Cognitive flexibility is one aspect of executive functioning that encompasses the ability to produce diverse ideas, consider response alternatives, and modify behaviours to manage changing circumstances. These processes are likely to be important for implementing cognitive restructuring. The present study investigated the impact of cognitive flexibility on older adults’ ability to learn cognitive restructuring. Neuropsychological measures of cognitive flexibility were administered to 40 normal community-dwelling older adult volunteers and their ability to implement cognitive restructuring was coded and analyzed. Results indicated that the majority of participants showed good cognitive restructuring skill acquisition with brief training. The multiple regression analysis suggested that those with poorer cognitive flexibility on neuropsychological testing demonstrated poorer quality cognitive restructuring. In particular, perseverative thinking styles appear to negatively impact the ability to learn cognitive restructuring. Further research is needed to clarify whether older adults with poor cognitive flexibility can improve their cognitive restructuring skills with repetition over treatment or whether alternative skills should be considered.

Key Words: Executive Function; Cognitive Restructuring; Cognitive Therapy; Geropsychology; Aging.
Introduction

There is an increasing body of evidence suggesting that cognitive behavioral therapy (CBT) is effective for older adults experiencing anxiety and depression (Ayers, Sorrell, Thorp, & Wetherell, 2007; Gallagher-Thompson, Steffen, & Thompson, 2010; Goncalves & Byrne, 2012; Gould, Coulson & Howard, 2012; Hendriks, Voshaar, Keijsers, Hoogduin, & van Balkom, 2008; Laidlaw, Thompson, Dick-Siskin, & Gallagher-Thompson, 2003; Serfaty, Haworth, Blanchard, Buszewicz, Murad & King, 2009). Despite the efficacy of CBT for older adults, there is still clinical debate about whether, and the extent to which CBT needs to be adapted (Koder, Brodaty, & Anstey, 1996; Laidlaw, 2001). There has been longstanding debate in regards to whether older adults are able to engage sufficiently with cognitive restructuring due to normal age related cognitive decline or the onset of dementia (Church, 1983; Evans, 2007; Koder et al., 1996; Steuer & Hammen, 1983; Wilkinson, 1997). Some researchers suggest that cognitive restructuring should be avoided or minimized due to difficulties in utilizing abstract reasoning abilities (Wilkinson, 1997). However, these recommendations are often made on the basis of clinical consensus, rather than empirical data. While modification of CBT may be needed for some older adults, this age group represents a heterogeneous group of people with varying sensory, cognitive, physical and social abilities. Suggestions for modification and simplification of therapy can have the unintended effect of implying that older adults are not able to effectively engage with therapy and result in clinicians being reluctant to introduce important therapeutic techniques in treatment. The necessity to adapt or remove more cognitive elements of CBT remains an important empirical and clinical question for the treatment of psychological distress among older adults.

Meta-analyses indicate that CBT is effective for the treatment of depression in older adults, and is superior to waitlist, care-as-usual, placebo and other control groups (Cuijpers et
al., 2006; Mackin & Arean, 2005). Recent meta-analyses indicated that psychological interventions, including CBT, show similar treatment response rates to pharmacotherapy for late-life generalized anxiety disorder (GAD), and that both psychological and pharmacological treatments were superior to control or treatment as usual (Goncalves & Byrne, 2012; Gould, Coulson & Howard, 2012). However, in two meta-analyses, CBT was not superior to other psychological inventions such as acceptance and commitment therapy and discussion groups for treatment of anxiety (Goncalves & Byrne, 2012; Gould, Coulson & Howard, 2012). Also, CBT appears to be less effective in older adults compared to younger adults (Gould, Coulson & Howard, 2012), and generally results in lower effect sizes compared to treatment for late-life depression (Gum & Areán, 2004). It is unclear why these differences occur and more research is clearly needed, particularly for the treatment of anxiety.

Research has consistently found that some cognitive abilities decline with age, even in the absence of any dementing illness (Mayr, Spieler, & Kliegl, 2001), while other areas are preserved. Domains controlled by the frontal lobe, such as executive functioning, psychomotor speed and working memory seem to be particularly affected by increasing age (Evans, 2007; Head, Kennedy, Rodrigue, & Raz, 2009; Lockwood, Alexopoulos, & van Gorp, 2002; Piguet et al., 2005; Steuer & Hammen, 1983). Executive functioning (EF) represents a heterogeneous set of cognitive processes, including problem solving, verbal reasoning, planning, organization, inhibitory control and self-monitoring. The presence of anxiety and depression in older adults can compound the age-related change in EF skills. Older adults with depression demonstrate varied EF skills ranging from almost intact functioning to severe impairment (Baudic, Tzortzis, Dalla Barba, & Traykov, 2004), potentially reflecting a distinct depression-executive dysfunction syndrome common in late-onset depression (Lockwood, Alexopoulos, Kakuma, & Van Gorp, 2000; Rapp et al., 2005).
It is unclear what the effect of anxiety on EF skills is due to methodological limitations in studies examining this issue. Heterogeneous samples of anxiety disorders, comorbid depression, and medication effects are common confounding factors in research into this relationship (Castaneda, Tuulio-Henriksson, Marttunen, Suvisaari, & Lonnqvist, 2008). However, most studies find reduced EF skills among older adults with anxiety (Beaudreau & O'Hara, 2008; Davis & Nolen-Hoeksema, 2000; Mantella et al., 2007). The impact of anxiety and depression on EF skill mirrors that seen in younger adults, but may be more devastating in older adults if it coincides with age related reductions.

There is emerging evidence that reduced EF skills can decrease the effectiveness of some psychological interventions for older adults. Mohlman and Gorman (2005) examined the role of reduced EF on treatment outcome following a CBT intervention for older adults with GAD and found that those with intact EF skills at the beginning of treatment improved on measures of anxiety following treatment. In contrast, those who had reduced EF skills before treatment and continued to demonstrate reduced EF after treatment did not show an improvement in anxiety symptoms as a result of treatment. Of particular interest was that a third group exhibited low EF prior to treatment, but demonstrated improvements on both measures of EF and anxiety over the course of treatment. The authors suggested that CBT may improve both cognitive functioning and anxiety symptoms for some people with low EF. A subsequent pilot study tested a CBT-based intervention for anxiety with older adults, augmented with cognitive remediation training (Mohlman, 2008). This study found that those who received additional cognitive remediation training showed superior treatment response to those who received the CBT intervention alone. There appears to be preliminary evidence that reduced EF may affect the efficacy of CBT for some older adults, however it is unclear which specific skills are mediating treatment effectiveness, or which CBT skills are assisting to improve EF skills post treatment.
Cognitive flexibility is one component of EF that appears to facilitate new learning. Cognitive flexibility refers to the ability to shift cognitive set, thought or attention in order to perceive, process or respond to situations in a different way (Eslinger & Grattan, 1993; Rende, 2000). Cognitive flexibility encompasses the ability to produce diverse ideas, consider response alternatives and modify behaviour and cognition in response to changing environmental demands (Rende, 2000). Cognitive rigidity occurs when the individual fails to recognize a change in environmental or task demands, and utilizes the same strategy despite it being ineffective. This process reflects a failure to identify that the situation is novel and requires a new strategy to be implemented (Canas, Antoli, Fajardo, & Salmeron, 2005). This form of rigidity where previously effective strategies continue to be used despite a change in task demands, often referred to as perseverative errors, is more frequently observed in neuropsychological testing with older adults compared with younger adults (Daigneault, Braun, & Whitaker, 1992).

The skills involved in cognitive flexibility seem likely to be important for the successful implementation of cognitive restructuring skills within CBT. Given the skill-based nature of CBT, it is important that individuals are able to adapt and learn new ways of responding to their internal and external environment. Cognitive restructuring typically involves stopping a habitual response (negative belief), generating new alternatives and shifting the previous negative belief to a more accurate one. Therefore, cognitive flexibility may be an important ability for CBT to be effective, in particular for the ability to implement cognitive restructuring skills. Research with young depressed adults has found that those who demonstrated either good or poor cognitive restructuring skill acquisition showed similar improvements in depressive symptoms immediately following treatment completion; however those with good cognitive restructuring skills were more likely to maintain these gains six months later (Neimeyer & Feixas, 1990). Given the crucial role of cognitive
restructuring skill acquisition to long-term treatment gains, there is a need to better understand the relationship between cognitive flexibility and cognitive restructuring skill acquisition in older adults whose EF skills may be generally reduced. This is particularly relevant given premature suggestions that cognitive therapy skills should be excluded or minimized during treatment with older adults.

The present study therefore investigated the relationship between cognitive flexibility and cognitive restructuring skill acquisition in a non-clinical older adult sample. Examining the relationship between cognitive restructuring and cognitive flexibility in a non-clinical sample allows for an exploration of these processes without the confounds of clinically interfering anxiety and depression symptoms, which are likely to negatively impact on cognitive flexibility. It was hypothesized that cognitive flexibility would be associated with poorer cognitive restructuring skill acquisition after controlling for cognitive status and measures of anxiety and depression.

Method

Participants

Forty-one community-dwelling participants (female N=31, 75.6%) aged over sixty years (range=60-86 years, M=68.07, SD=6.34) were recruited from advertisements in local newspapers for “happy healthy older adult volunteers”. While happiness was not an inclusion criteria, the advertisement was worded as such to minimize the likelihood of clinically depressed and anxious volunteers. Participants were initially screened on the telephone and asked some basic questions to assess functionality and ensure they could attend a testing session at the university. Participants were excluded if they experienced anxiety, depression or any other mental health condition to a clinically significant degree. Two participants reported using benzodiazepine medication occasionally to aid sleep, and one participant
reported the occasional use of sertraline. Sixty-nine percent reported using medication for physical health problems, primarily for management of hypertension and high cholesterol. One male participant (aged 80) was excluded after testing due to severe hearing impairment that prevented accurate understanding of task instructions. Demographic information for the remaining participants is provided in Table 1.

**Materials**

**General Cognitive Status and Working Memory**

*Mini-Mental State Exam* (MMSE; Folstein, Folstein & McHugh, 1975): This brief 30-point test is commonly used to screen for cognitive impairment and as a severity marker for dementia progression. This test assesses orientation, planning and organization, attention, short term memory, basic language skills and motor skills. Scores \( \leq 24 \) are indicative of cognitive impairment.

*Digit Span (Wechsler, 2008)*: The Digit Span subscale from the Weschler Adult Intelligence Scale – Fourth Edition (WAIS – IV; Wechsler, 2008) and recommended scoring was used to assess working memory capacity. This subtest requires a person to actively maintain information in conscious awareness, perform some mental operation or manipulation with it, and produce a result. Only the backwards version was used in the analyses.

**Measures of Cognitive Flexibility**

*Wisconsin Card Sorting Test- Computer Version 4 (WCST-C4; Heaton & PAR Staff, 2003)*: The WCST-C4 is a widely used computerized neuropsychological test that requires test takers to sort decks of cards into four piles. The participant must determine the current matching rule (color, shape or number) based on feedback to their previous sorts. This task
measures abstract reasoning and ability to shift cognitive strategies in response to environmental changes (Heaton et al., 1993). This task requires strategic organization and planning, the ability to effectively utilize feedback to shift cognitive set and the ability to modulate impulsive responding (Spreen & Strauss, 1998). Normative data corrected for age and education was used from Heaton et al. (1993) to score participants’ responses. Scoring focused on the percentage of perseverative and non-perseverative errors corrected for age and education given these are important measures of cognitive flexibility from this task.

*Trail Making Test Part B (TMT-B; Reitan & Wolfson, 1985):* TMT-B is a pencil and paper task that involves alphanumeric sequencing. It measures mental flexibility and set shifting in addition to visual processing and motor speed (Spreen & Strauss, 1998). During administration errors are pointed out by the examiner and the participant is redirected from the point the mistake occurred without stopping the timer. TMT is scored by completion time with greater completion time indicating poorer functioning. Normative data corrected for age and education was used from the Mayo’s Older American’s Normative Studies to score the task (MOANS; Ivnik et al., 1996). Part A was also administered but not scored as it does not relate specifically to cognitive flexibility.

*Controlled Oral Word Associations Test (COWAT; Benton & Hamsher, 1976):* The COWAT is a widely used test of verbal fluency, which requires the participant to generate as many words as they can beginning with a specified letter during a one-minute interval excluding proper nouns. The standard letters used for this phonemic fluency task were F, A and S (Strauss, Sherman, & Spreen, 2006). Repetitions were excluded from the total score. MOANS normative data corrected for age and education was used to score this task (Ivnik et al., 1996).

*Stroop Color-Word Test (Golden, 1978):* The Stroop Color-Word Test is commonly used to assess inhibitory control, cognitive flexibility and selective attention (Strauss et al.,
This task consists of three parts: a Word trial, a Color trial and a Color-Word trial. The Word trial requires the participant to read aloud from a list of color words in an alternating sequence under time constraints with the words printed in black ink. The Color trial requires the participant to name the color of the ink that sequences of X’s are printed in under time constraints. The Color-Word Trial requires participants to name the color of the ink that color-incongruent words are printed in, involving the need to inhibit the tendency to read the word in order to correctly name the color of the ink, with a lower score reflecting poorer functioning (Strauss et al., 2006). MOANS normative data corrected for age and education was used to score this task (Ivnik et al., 1996). Only the Color-Word trial measures cognitive flexibility and so only the scores from this trial were included in the analyses. The Stroop Color-Word test demonstrates good reliability and validity (Golden, 1978; Strauss et al., 2006).

*Ruff Figural Fluency Test (RFFT; Ruff, 1988):* The RFFT is a non-verbal measure of design fluency that requires participants to generate unique designs by connecting patterns of dots under time constraint. The error ratio reflects the participants’ ability to minimize repetition while maximising unique design generation, and the error ratio score is corrected for age and education (Ruff, 1988).

**Symptom Measures**

*Geriatric Anxiety Inventory (GAI; Pachana et al., 2007):* The GAI is a 20-item self-report measure designed for use with older adult populations to indicate severity of anxiety symptoms in the elderly. A cut-off score of 8 (out of 20) indicates clinical levels of anxiety with sensitivity of 73% and a specificity of 80% (Pachana & Byrne, 2012). This measure shows sound psychometric properties for use with community, residential and psychiatric
samples (Pachana & Byrne, 2012; Pachana et al., 2007). The internal consistency for this sample was acceptable (Cronbach’s alpha=.78).

**Geriatric Depression Scale (GDS; Yesavage et al., 1982):** The GDS is a 30-item self-report screening measure to assess the severity of depressive symptoms in older adults. A score of 11 or more (out of 30) is indicative of clinical levels of depression (Brink et al., 1982). This measure demonstrates good reliability and validity for use with older people (Yesavage et al., 1982). The internal consistency for this sample was acceptable (Cronbach’s alpha=.74)

**Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990):** This 16-item self-report scale assesses the extent to which a person engages in worry. A cut-off of 50 predicts a diagnosis of Generalized Anxiety Disorder in samples of older medical patients referred for anxiety (Stanley et al., 2003). The measure has shown high internal consistency, good test-retest reliability, and discriminant validity with other measures of anxiety and depression and is appropriate for use with older persons (Meyer et al., 1990). The internal consistency for this sample was good (Cronbach’s alpha=.87).

**Cognitive Restructuring Task**

In order to assess cognitive restructuring (CR) skill acquisition, a task was developed for this study which took 60 minutes to complete. The task was administered by a registered psychologist with postgraduate training in clinical psychology and CBT. Based on the suggestions from Zeiss and Steffen (1996), the administration of the CR task consisted of three multimodal training phases in order to promote optimal learning for older adults using a “say it, show it, do it” format. The initial teaching phase consisted of the experimenter demonstrating the link between thoughts and feelings using a standardized example. The exercise highlighted the central role of cognition in affective responses, showing how
different cognitions can result in different feelings in the same situation. For example, it was demonstrated that for the ambiguous situation where a strange noise is heard outside at night, different interpretations can elicit different emotional responses. Next, a completed example of a structured CR form was presented and explained to participants in a standardized format and participants were encouraged to ask questions. The example situation was running late to meet a friend, with the irrational thought of “she will be angry with me and will go home”. The CR form used the format ‘situation – thought – feeling’ followed by a disconfirmatory evidence collecting phase where seven prompting questions were presented to prompt generation of evidence to dispute the thought (e.g. “What would a friend tell you in this situation”, “What has happened in the past?” and “How could you cope if this was true?”). The final section of the form consisted of generating a helpful replacement thought and re-assessing the subjective distress rating on the affect associated with the original cognition. During the practice phase, participants selected a problem and completed the form from the perspective of a friend. Participants were assisted to identify the unhelpful thoughts and rate the strength of their affective response. They then worked through the form in the way they had been shown in the previous example, with assistance given by the experimenter as needed. In the final testing phase, participants selected a personal problem and were again assisted by the experimenter to identify the target unhelpful cognition. They then proceeded to complete the remainder of the CR form unassisted.

Only the final CR task that participants completed unaided was scored based on adapted coding criteria from Neimeyer and Feixas (1990). Scoring was completed by an independent clinically trained psychologist with accreditation as a CBT therapist with the British Association for Behavioural and Cognitive Psychotherapies. The scoring system was designed to evaluate participants’ competence in completing each of six components (generation of appropriate situation, unhelpful thought, emotion, evidence to dispute the
thought, a replacement thought, and the outcome emotion), with higher scores reflecting better quality responses. Scoring criteria are outlined in Table 2. To check reliability of scoring, 20% of the CR tasks were scored by the first author (CJ) and resulted in acceptable interrater reliability (k=0.80).

**Data Analysis**

Correlational analyses were used to examine the relationship between emotional symptoms and measures of cognitive flexibility and between emotional symptoms and cognitive restructuring ability. Regression analyses were used to examine the relationship between neuropsychological measures of cognitive flexibility and cognitive restructuring ability. Age and education-adjusted percentile scores were used in analyses for all neuropsychological measures.

**Procedure**

This study was approved by the Macquarie University Human Research Ethics Committee, and all participants provided informed written consent. Participants telephoned the researcher in response to a newspaper advertisement, and were briefly screened over the phone for current clinically significant mental health problems. Participants first completed the questionnaire tasks at home and brought them to the testing session conducted at Macquarie University during which they completed the neuropsychological tasks, followed by a short break, and then they completed the cognitive restructuring task. The neuropsychological tasks were completed first by all participants to minimize the impact of fatigue.
Results

Descriptive Statistics

None of the participants fell within the probable dementia range (MMSE ≤ 24). Two participants scored above the 50 point cut-off on the PSWQ (52 and 62) suggesting possible GAD. Otherwise, all scores on measures of anxiety and depression fell within the non-clinical range. Table 3 summarises descriptive statistics for each measure of anxiety and depression, along with the neuropsychological measures. The percentage of participants who fell in the borderline to impaired range on neuropsychological measures (lower than the 9\textsuperscript{th} percentile) is also reported in Table 3. All variables met the assumptions for normality, linearity and constant variance of errors except for the COWAT (skewness=-0.826, kurtosis=2.007), and the MMSE was negatively skewed (skewness=1.234, kurtosis=0.429), as would be expected among a cognitively intact sample.

Correlational Analyses

Given that depression and anxiety are found to impact EF (Beaudreau & O'Hara, 2008; Baudic et al., 2004), we first examined the bivariate correlations between the symptom measures of anxiety and depression and the neuropsychological cognitive flexibility measures. None of these correlations were significant (see Table 4). Given that anxiety and depression might be associated with worse cognitive restructuring ability (e.g., due to difficulties with concentration), we also examined relationships between symptoms of anxiety and depression and cognitive restructuring skills. None of these correlations were significant (all $p$’s >.05).

Education and gender were not significantly correlated with performance on the neuropsychological measures ($p$>.05, see Table 4). Age was significantly correlated with TMT-B and the percentage of Perseverative Errors made on the WCST despite scores already
being adjusted for age in the scaled scoring. Also working memory (Digit Span Backwards) was significantly correlated with the percentage of perseverative errors on the WCST and COWAT performance (see Table 4). As such, age and working memory were included in regression analyses to account for these relationships.

To assess the relationship between cognitive status and measures of cognitive flexibility, correlations between the MMSE and neuropsychological measures were conducted. MMSE performance was correlated with Stroop performance only (see Table 4). To account for the role of cognitive status, MMSE performance was included in the regression analysis.

Significant bivariate correlations were found between CR quality and MMSE, RFFT Error Ratio and WCST Perseverative Errors (see Table 4). Further analyses were conducted to examine this relationship.

**Cognitive Restructuring Ability**

Each section of the CR form was coded for quality. Given that participants were assisted by the experimenter to generate appropriate target cognitions to complete the CR task, it was not surprising that the CR Evidence and CR Replacement Thought sections were the main sections demonstrating variability in scores. A total score that summed all six sections of the CR process had limited variation in scores (Range 9-14, M=12.9, SD=1.482). Therefore we created a score that summed the CR Evidence and CR Replacement Thought sections only (range 1-6, M=4.975, SD=1.405). The majority (77.5%) of older adults were able to learn this skill well with only one hour of instruction, scoring ≥5 out of the possible quality score of 6. The other 22.5% demonstrated difficulty generating evidence to dispute the unhelpful thought, and integrating that evidence into a more realistic replacement thought (scoring ≤4).
Cognitive Flexibility and Cognitive Restructuring Ability

A linear regression analysis was conducted to examine the relationship between CR skill acquisition and cognitive flexibility. All cognitive flexibility measures were entered simultaneously in the regression, along with age, MMSE score and working memory (Digit Span Backwards). Age and working memory were included in the regression analysis due to the significant correlation with several neuropsychological measures. MMSE performance was included to assess whether cognitive flexibility impacted cognitive restructuring above and beyond the effect of cognitive status. Result of the multiple regression analysis are included in Table 5. The quality of cognitive restructuring skill was significantly predicted by the MMSE score, RFFT Error ratio score, and percentage of perseverative errors made on the WCST (see Table 5). The overall model explained 53.8% of the variance in cognitive restructuring quality.

To look at the difference in test performance on the predictive measures for those who demonstrated poor quality and good quality CR, 31 participants were classified into the good quality CR group and scored 5-6, while 9 participants were categorised as falling in the poor quality CR group, scoring ≤ 4 for the quality of their CR as there was a natural split in the sample at this point. A one-way ANOVA revealed that those in the poor CR category demonstrated significantly lower MMSE scores, F(1, 38)=5.190, p=.028, with a mean of 28.890 (SD=.928) compared to those with good quality CR (M=29.580, SD=.765), and significantly lower RFFT Error Ratio percentile scores, F(1, 38)=5.448, p=.025, with a mean of 65.922 (SD=23.180) compared to the mean of the good quality CR group (42.310, SD=27.586). The difference between the groups on WCST perseverative errors performance showed a non-significant trend towards being different between the groups, F(1, 38)=3.595,
p=.066, with the poor CR quality group having lower mean scores (M=50.780, SD=33.767) than those in the good quality CR group (M=69.770, SD=24.142).

**Discussion**

This novel study examined the impact of cognitive flexibility on cognitive restructuring skill acquisition in older adults. First, contrary to suggestions that the elderly are unable to effectively use cognitive restructuring skills (Church, 1983; Wilkinson, 1997), results of this study broadly support the use of cognitive restructuring with this population. Seventy-eight percent of the sample were able to implement the cognitive restructuring technique in this single session experimental task with reasonable or strong quality responses after brief training. This finding supports the notion that for those with intact cognitive flexibility and normal levels of anxiety and depression, cognitive restructuring is a skill that can be satisfactorily performed by older adults. For the minority of people who demonstrated poorer quality cognitive restructuring skills, this difficulty was related to impairments in cognitive status and cognitive flexibility performance.

As cognitive status declined and the number of perseverative errors increased, the quality of cognitive restructuring became poorer. There appears to be a necessity for both intact basic core cognitive competencies and cognitive flexibility that allows one to learn from errors and adapt their thinking in order to acquire good cognitive restructuring skills with brief training. Generally, these basic skills deteriorate in people with mild cognitive impairment and dementia, possibly indicating limitations for implementing cognitive restructuring when these basic processes are affected. The two cognitive flexibility measures that significantly predicted cognitive restructuring quality both involved minimising perseveration. The percentage of perseverative errors made on the WCST represents the extent to which the individual continued responding to a stimulus characteristic despite
explicit and repeated feedback that this was incorrect. The RFFT, although being a measure of design fluency, also provides an error ratio that calculates the ratio of perseveration to unique design generation. There is no explicit feedback on perseverative behaviour, and the individual is required to monitor this internally. This is similar to skills required in cognitive restructuring, where the person must monitor their tendency to perseverate back to their unhelpful cognition and modify this as needed. Perseveration was consistently related to poorer cognitive restructuring ability, while the ability to generate new ideas was not.

Unexpectedly, inhibitory control as measured by the Stroop task and set-shifting as measured by the TMT-B were unrelated to CR skill acquisition. It is not clear why this is the case. Possibly, inhibitory control is not associated with CR skill acquisition. However, given our sample was non-clinical; it is possible that CR may be an easier process in the context of non-clinical worry and hence may be less affected by inhibitory control. Previously, Price and Mohlman (2007) found that inhibitory control as measured by the Stroop task was associated with worry severity in a clinical sample, but not in the non-clinical sample. Future research should assess whether improved inhibitory control is related to CR skill acquisition in an older sample with increased worry severity, including those with GAD. Also unexpectedly, verbal fluency as measured by the COWAT was not associated with CR skill acquisition, even though design fluency (as measured by the RFFT) was. Fluency assessed by the COWAT represents the total number of words produced; however, this total score does not necessarily reflect a person’s ability to produce diverse ideas (Rende, 2000), as individuals may use non-flexible strategies to complete this task. However, it is also important to consider that the relationship between these measures may also have been non-significant due to limited statistical power given the relatively small sample size.

A limitation of the experimental procedure used here is that participants learned CR in a single one hour session. When introduced in therapy, CR is usually introduced gradually
over several sessions, with lots of repetition of the skill and guidance from the therapist to promote effective learning. It is possible that those who showed poor CR skill acquisition may show improved ability with more repetition of the skill. This is a likely possibility given the results by Mohlman and Gorman (2005) who found that some of the participants with low EF skills pre-CBT treatment demonstrated significant improvements in both anxiety symptoms and cognition post-CBT. A second potential limitation of this study is that the wording of the recruitment advertisement requesting “happy” older adults may have biased the sample. Happy older adults have less physical illnesses and tend to be more physically active than unhappy older adults (Koopmans et al., 2010). While happiness was not an inclusion criteria for the study, and many of the participants experienced normal levels of emotional distress related to health, family relationships and life events, it is possible that the sample may be biased towards higher-functioning older adults. A third limitation of this study is that the CR task was skewed, with majority of participants (77.5%) scoring high, likely due to the structure of the task. A more complex task allowing more variation in performance may be informative in future studies. Finally, due to the high correlation between the measures of cognitive flexibility, high multicollinearity between the independent variables is likely to have impacted on the results of the multiple regression analyses, and future research would ideally select fewer cognitive flexibility measures.

It is noteworthy that in this study there was no relationship of anxiety and depression with cognitive flexibility, which might not be surprising given that this was a non-clinical sample with low levels of anxiety and depression. It is possible that CR is an easier skill to learn when emotional distress is low and therefore these findings may not generalize to clinical populations. However, CBT has been demonstrated to be an effective technique for the prevention of anxiety and depressive disorders in non-clinical older populations with lasting benefit (van’t Veer-Tazelaar et al., 2009; van’t Veer-Tazelaar et al., 2011) and so the
CR process is likely to be used similarly in both clinical and non-clinical populations. Future research should compare these results to a population of older adults with clinical anxiety and mood disorders to determine the impact of cognitive flexibility on CR ability in emotionally distressed individuals. This is particularly important given that individuals with clinical anxiety and depression are likely to be more perseverative in their thinking style, and demonstrate poorer cognitive flexibility and hence poor quality cognitive restructuring skill acquisition. This study found that less than one quarter of older adults performed poorly on the cognitive restructuring task. However, those with anxiety and depression are likely to have impaired cognitive flexibility, and may be disproportionately likely to fall into this category. Further research should also examine whether individuals presenting with poor cognitive flexibility can improve their cognitive restructuring skills with increased repetition of the skill to enhance learning or can enhance their skill acquisition using cognitive training specifically aimed at building flexibility.

The results of this study support the idea that most older adults are able to learn simple CR effectively after brief training. Intact cognitive status appears to be important for the implementation of cognitive restructuring with brief training. Cognitive flexibility appears to impact CR skill acquisition above and beyond the influence of cognitive status. There appears to be a minority of older adults who were more rigid in their thinking, and these individuals demonstrated poorer CR skill acquisition. In particular these individuals had a perseverative thinking style and demonstrated difficulty recognizing errors in thinking and making appropriate corrections. The implications of these findings suggest that CR may be a more difficult therapeutic skill for older adults who are more rigid in their thinking, or with decline in cognitive status. It may be the case that older adults with poor cognitive flexibility are likely to find CR more difficult to learn and might need extensive practice and repetition to learn this skill. Alternatively, it may be the case that other CBT strategies, such as
behavioral activation, behavioral experiments and relaxation will be more useful for these individuals. Finally, although not specifically tested in this study, it is important to consider that even poor quality cognitive restructuring may result in a change in interpretation of situations and consequent emotional reactions to an event. Given that a large proportion of older adults were able to benefit from brief training, we posit that those with cognitive impairment or rigid thinking styles should not be excluded from learning cognitive restructuring.
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