Effectiveness of Cognitive Skills Training For Dually Diagnosed Persons With Mental Illness

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Research suggests that a number of persons who utilize community mental health services experience cognitive limitations that adversely impact their ability to benefit from those services. This may be particularly true for individuals who experience the dual conditions of mental illness and substance dependence. The provision of traditional "cognitive rehabilitation" may not be feasible either because most community rehabilitation is not sufficiently intensive or because the cognitive impairments may not be amenable to change. In these cases, an alternative approach is to provide individuals with strategies for understanding the extent and contexts of their cognitive limitations, and then assisting them in developing compensation strategies for accommodating to their cognitive limitations. This study reports on a pilot study of cognitive compensation skills training (CCST) as an adjunct to alcohol and drug treatment for persons with mental illness coexisting with substance dependence.

Statement of the Problem

It is estimated that as many as half of all individuals with a serious mental illness are also dependent on alcohol and/or illicit drugs (Bellack & DiClemente, 1999; Kessler et al., 1996). In the rehabilitation field, substance abuse among persons with mental illness has been found to impact negatively on employment and rehabilitation outcomes (Brown & Saura, 1996). Finally, substance abuse diagnoses often cost more to treat than other chronic conditions (e.g., arthritis, asthma, and diabetes), especially for individuals with mental health claims (Garnick, Hendricks, Comstock, & Horgan, 1997).

Mental illness and substance abuse both can lead to cognitive impairments, but when these conditions co-occur, cognitive impairments are especially likely to impact treatment outcome (Bates & Convit, 1999;

Burns & Teesson, 2002; Ross, 1995). Effective treatment of mental illness must take into account differences among consumers in their levels of cognitive functioning (Silverstein, Hitzel, & Schenkel, 1998). This is of particular importance when additional disabilities such as substance use disorder or traumatic brain injury are present. However, the vast majority of chemical dependency treatment programs do not address the potential cognitive limitations of their clients (Drake et al., 1993; Kaufman & Charney, 2000). For example, many treatment models utilize psychoeducational components, which typically involve didactic instruction in a group setting (e.g., teaching the clients about their illnesses and explaining risk factors). The extent of memory, attention/concentration, and analytical thinking deficits frequently present in persons with mental illness (particularly in combination with prolonged substance use and/or TBI) may render instructional components delivered at a "standard level" less effective. Consequently, it has been suggested that cognitive limitations that go unaddressed are one important cause of treatment failures in programs serving dually diagnosed mental health consumers (Bellack & DiClemente, 1999; Wilson, 2000).

Hypotheses

We proposed to pilot test CCST in two substance use disorder treatment programs among persons with dual diagnoses, using a randomized control group design. The three primary hypotheses are as follows:

1. Participants in treatment will exhibit cognitive dysfunction across one or more of three major areas: executive functions, attention, and memory.

2. CCST completers will demonstrate improved cognitive functioning and greater knowledge of cognitive compensation strategies, relative to participants in the control group.

3. CCST completers will demonstrate greater levels of treatment improvement relative to participants in the control group, including less use of alcohol and other drugs and lower levels of psychiatric symptoms, as well as higher therapist ratings and self-perceptions of functioning and higher levels of life satisfaction.

Methodology

Intervention and Subjects. The intervention was initially piloted in the Consumer Advocacy Model (CAM) program in Dayton, Ohio, which is an outpatient alcohol, drug, and mental health treatment

provider specifically tailored to persons with disabilities. A second intervention site was Nova House also in Dayton, and specifically their residential "substance abuser-mentally ill" (SAMI) program was recruited for this study. Initially, any new program consumer 18 years of age or older with a diagnosed mental illness was eligible for enrollment; however, this inclusion protocol was expanded in the last 18 months of the study to include anyone with a substance use disorder and any other, co-existing disability. Participants in both the experimental and control groups were compensated the equivalent of $3 per session to be involved in the study, in addition to receiving $10 for the intake and follow-up assessments. Randomly assigned control subjects had to be involved with a comparable amount of programming at their treatment site weekly as the CCST group time in order to be accepted.

The CCST modules consisted of a series of group sessions specifically addressing selected aspects of cognitive functioning, including Understanding Meta-Memory and Perception, Problem solving and Short-term Memory, Long-term Memory, Long-term and Remote Memory, Attention, Foresight and Planning, Judgment and Reasoning, Problem Solving and Decision Making. A 250 page training manual was developed and field tested over the course of the study, including a 93 page memory notebook with exercises and activities that was given to each participant. Each group was conducted by a Masters level research assistant specifically trained in the modules. Originally intended to be 24 sessions in length (two times per week for three months), the CCST intervention was reduced in the total number of sessions to eight (one session per week for two months), but the session time was doubled in length to allow for more in-group practice sessions. The changes in CCST were necessary in order to accommodate transportation and timing barriers reported by participants and clinical staff in the primary study site.

Instruments. The instrumentation involved several neuropsychological measures, alcohol and drug use severity ratings, determinations of mental health status, and measures of satisfaction with life. The primary instruments for quantifying cognitive impairments involved a battery of seven neuro-cognitive measures. The neurocognitive measures were chosen based upon their perceived emphasis in regard to three major areas of the cognition process which previous research suggests are impacted by substance use/abuse.

MEASURES/TESTS	PERCEIVED AREA OF PRIMARY COGNITIVE EMPHASIS
Brief Test of Attention (BTA)	**Attention**
Ruff 2 & 7 Test	**Attention**
Trail Making Test	**Executive Functioning**
Revised Token Test	**Executive Functioning**
Ravens Coloured Progressive Matrices Test	**Executive Functioning**
Rey Complex Figure Test (RCFT)	**Memory**
Rey Auditory Verbal Learning Test (RAVLT)	**Memory**

Results

The analyses are based on a combined sample of 155 individuals (112 experimental; 43 control) participating in either CAM or Nova House, and follow-up data were obtained from 93 (62 experimental; 31 control) of these persons. On average the Experimental subjects completed 15 of 20 hours of the CCST modules with less than 25% completing 12 hours or less and more than 25% completing the entire program.

(insert Table 1 approximately here)

Although the initial intent was to recruit subjects with coexisting mental illness, this did not result in recruitment of sufficient subjects. Therefore, subjects with other co-existing disabilities were also recruited during the second 18 months of the project, with the approval of ODMH staff. Approximately 60% of the entire cohort was diagnosed as having a mental illness. Although the subjects from the residential and outpatient programs did not appear to differ in regard to their overall ratings on the Brief Psychiatric Rating Scale (BPRS), they did with regard to the "Sense of Helplessness & Hopelessness" they reported - the expression of hopelessness/helplessness voiced by the outpatient subjects was significantly higher than that raised by subjects housed in the residential program.

Approximately 31% of the CAM clients reported having a physical disability, while 35% reported having a speech impairment, 17% reported having a hearing impairment, 9% reported having a visual problem, and 10% reported that they were suicidal.

Hypothesis 1: Participants will exhibit cognitive dysfunction across one or more of three major areas: executive functioning, attention, and memory.

Criteria scores observed for study participants were compared with normative data. Each criterion score was converted into a normative-based percentile value that was then evaluated at or below the 10^{th} percentile (deemed a stringent measure of cognitive dysfunction) or above the 10^{th} percentile (deemed to not be reflective of a cognitive dysfunction). The results of this initial set of transformations are summarized in Table 2, and they confirm that participants were well below available normative samples in regard to cognitive functioning.

(insert Table 2 approximately here)

Next, the numbers of subjects who exhibited "impairments" in none, one, two, or three of the cognitive areas –Attention, Executive Functioning, and Memory - were determined and then compared with "expected" frequencies under the null form of the hypothesis (i.e., "Participants will exhibit no cognitive dysfunction scores across any of the three major areas of cognition"). If one assumes that "cognitive impairments" are unrelated, then the expected percentages of cases one might expect to observe under the null form of the hypothesis would be 70% (none), 10% (one), 10% (two), 10% (three), which would reflect the use of the normative-based 10^{th} percentiles when generating the "impairment" indicators.) The results associated with this analysis are summarized in Table 3. Participants did exhibit cognitive impairments across one or more of the three cognitive areas specified. For that matter, over 40% of the subjects exhibited "impairments" across all three cognitive areas. Related descriptive data revealed that roughly 37% of the subjects had an attention-related "impairment", 74% had executive functioning "impairment", and 73.5% had memory "impairment".

(insert Table 3 approximately here)

Hypothesis 2: CCST completers will demonstrate improved cognitive functioning and greater knowledge of cognitive compensation strategies, relative to participants in the control group.

The primary concern focused upon assessing whether the changes in the cognitive criteria observed for the "experimental" subjects differed significantly from the associated changes observed for the control

subjects. The descriptive statistics associated with the indicated analysis are summarized in Table 4, while the MANOVA results are provided in Table 5.

(insert Table 4 approximately here)

(insert Table 5 approximately here)

Generally speaking, scores on cognitive tests tended to increase from the pre to post-tests for both the intervention and the control groups. Based on data in the accompanying tables, this hypothesis could not be supported. At the same time, the changes observed across the two groups of subjects in the study appear to be quite constant (i.e., positive changes in one group are generally mirrored by like changes in the other group), which suggests that there may be a significant pre vs. post main effect. The related results in Table 5 verify that in effect such a significant main effect was observed. That is, the overall performance of all the subjects in the study (both Control and Experimental subjects) appeared to increase from the time of pre-testing to the time of post-testing by an amount that could not be attributed to "chance" alone.

The results of the "Experimental vs. Control" Hypothesis summarized in Table 5 reaffirm the comparability of the criterion scores across the two experimental conditions or groups. The overall levels of criterion performance of the two groups of subjects appeared to be quite similar, when collapsed across the pre- and post-tests. When taken together, the results show that cognitive performance on six of the 14 cognitive measures for the subjects in the study increased significantly between the time of pre-testing and the time of post-testing, with five of the six being in the memory area. Based on recent literature regarding the impact of alcohol and drug use on cognitive functioning, these findings may suggest that a combination of practice effects and "sobering up" may account for the consistent improvements (Bates, et al., 2002).

Hypothesis 3: CCST completers will demonstrate greater levels of treatment improvement relative to participants in the control group, including less use of alcohol and other drugs and lower

levels of psychiatric symptoms, as well as higher therapist ratings and self-perceptions of functioning and higher levels of life satisfaction.

The results generated via the related mixed model ANOVAs are summarized in Table 6 (Descriptive Statistics) and Table 7 (Mixed Model Analyses). Overall, the results presented in these Tables do not support Hypothesis 3. More specifically, those results do not demonstrate that participation in the CCST Modules leads to greater levels of treatment improvement than does participation in the control group. Apparently the changes noted are not uniquely related to use of the CCST Modules, but are effects associated with participation in substance abuse treatment.

One of the most consistent results dealt with the changes in subject's rating of their cognitive scores between "pre" and "post" testing. For some reason, between those two assessment points the respondents, both those in the control and experimental groups, significantly reduced their self-appraisals of their own cognitive skill levels. As shown in Table 7, these changes were observed across all cognitive areas considered.

(insert Table 6 approximately here)

(insert Table 7 approximately here)

Discussion and Conclusions

Cognitive Functioning of Study Participants. Regardless of the specific combination of identified disabilities, subjects at both research sites were documented with appreciable levels of cognitive impairment. At the time of entry into the study, cognitive performance of subjects was substantially lower than normative samples, with a third or more at or below the 10^{th} percentile on performance averaged across all measures. Although memory functions were the most depressed, deficits in attention and executive functioning also were low. Notably, 61% of subjects on the Trails Making Test – Part B and

58% of subjects on the RCF – Immediate Recall scored in the lowest 10% on the published norms of those instruments.

Cognitive deficits tended to be greater among persons who were older, had less stable housing, lower educational attainment, membership in a minority group (principally African American), and a history of incarceration. Moreover, persons reporting a physical disability and/or traumatic brain injury also were more likely to have greater cognitive impairments. Some findings in this study also suggest that having a "physical disability" is more highly correlated with cognitive impairments than having mental illness. Recent literature has alluded to "multiple co-morbidity" as being prevalent for the most needy persons in substance use disorder treatment and the current study appears to substantiate this (Shavelson, 2001).

Utilizing data from predictor variables in Table 7, the factors that correlate most highly with cognitive impairment include lower education attainment level and a reported physical disability (p=.000). These are followed by race (minority) and high school drop out status (p=.001). Alcohol use during lifetime, severity of mental illness, and health transitions in the last year form the third tier of correlates (p=.01), followed by a fourth tier of "live in own place", experience a brain injury, months and days in jail, employment status, and scores on the Brief Psychiatric Rating (p=.03). Persons who experience multiple correlates from the above factors (likely many persons in substance abuse treatment) may benefit from screenings for cognitive impairment prior to treatment planning. Traumatic brain injuries, sometimes not reported or diagnosed, may be a particularly common occurrence for persons in chemical dependency treatment (Acquilano, et al., 1995).

Recent research on cognitive impairments associated with persons who experience substance dependence clearly indicate that neuropathology from substance abuse contributes to diminished cognitive functioning for many treatment clients (Heffernan, et al., 2002; Bates et al., 2002; Tracy & Bates, 1999). The current study suggests this as well, given that cognitive functioning levels between the intervention and control groups tended to show similar degrees of change from pre to post testing. In the

current study, illicit drug use was associated with greater levels of cognitive impairment than was alcohol use; however, both alcohol and illicit drug use appeared to impact cognitive functioning.

Cognitive Measures Require Norming for Special Populations. A detailed review of the instrument battery and the associated norms suggested that one potential benefit of this study would be to publish normative data on study participants. It can be argued that substance dependence treatment agencies in the U.S. serve comparable populations of persons on a regular basis, although it is not common to identify functional levels of cognitive impairment at the time of treatment intake. For that reason, the test data available through this study are being analyzed in order to delineate instrument norms for the subject population. These results will be disseminated through conferences and papers, as well as inclusion in the SARDI website. Increasingly, treatment providers are embracing an "integrated model" of services provision, and more comprehensive functional assessments are becoming more commonplace.

Cognitive Compensation Skills training. One of the most challenging aspects of this study was to operationalize the concept of "cognitive compensation skills". These are by definition "compensatory" skills used to overcome cognitive deficits, or to "recompense for something" (Webster's Unabridged Dictionary, 1994). As such, cognitive compensation skills may or may not be reflected in change scores on traditional tests of cognitive functioning. There is debate in the literature about how and where to "recompense" (Wilson, 2000). The approaches range from concentrating on cognitive areas such as unilateral attention, memory, metamemory, executive functions, verbal skill, and processing speed. Other approaches focus on techniques for improving performance such as rehearsal strategies, talking books, memory books, over-learning, computer enhanced learning, and electronic personal desk assistants. Yet other approaches tend to be more environmentally focused such as environmental manipulation, posting cues and signs in the treatment setting, or introducing other environmental cues (Bates et al., 2002; Wilson, 2000). Moreover, the list of cognitive instruments utilized in related studies are quite diverse and extensive, as alluded to in the literature review in the first section of this report.

Considering that the present study was a pilot project in a new and nearly untested area, there were several challenges to and limitations in the design and execution of the CCST. One challenge was in the

measurement of "cognitive compensation skills", as mentioned above. Although cognitive functioning levels were assessed, these may not be the most direct means for measuring acquisition of compensation skills. In future studies, the investigators plan to initiate a series of "real time" tests of compensation skills, where subjects will be required to choose from a group of compensation strategies and then apply one to a common scenario. Measurement will then be based on 1.) knowledge of multiple compensation strategies, 2.) ability to choose an appropriate strategy, and 3.) demonstration of the strategy in context. Improvement in performance also will be quantified. In keeping with the primary modalities utilized in mental health and chemical dependency treatment settings, the majority of compensation skills will address auditory learning processes.

A particular contribution of the current study was the documentation of the pervasiveness of cognitive impairments among clients who experience mental illness or other disability conditions across two different chemical dependency treatment sites. Although additional study is necessary in order to more fully understand the most common etiologies for cognitive impairments, it is clear that a substantial portion of persons with dual diagnoses within the chemical dependency treatment system experience depressed levels of cognition that can very likely impede their progress to stabilization and recovery. Chemical dependency treatment providers should include measures of cognitive functioning as routine components of their intake assessment battery and the results from these instruments should be considered when formulating client treatment plans. Moreover, subjects in this study, irrespective of their assignment to experimental or control conditions, demonstrated cognitive improvements over their first two to three months of enrollment in the program. Interestingly, these effects appeared to hold for persons in a residential treatment program, as well as for those in an outpatient program. Self-reported substance use was far more common at follow up for persons in the outpatient program, therefore simply being abstinent from substance use may not be directly related to the observed changes.

Research is needed to better understand the etiologies of cognitive impairments in persons who are dual diagnosed, both related to aspects of mental illness and the influence of alcohol or other drug use. For example, research has shown that both mental illness and substance dependence can independently

lead to significant cognitive dysfunctions, but the combination of these factors may increase cognitive impairments multiplicatively, not additively.

Given the potential clinical importance in determining levels of cognitive functioning among clients in substance abuse treatment settings, more research is needed on instruments and their related clinical population norms, particularly those applicable to dual diagnosed populations. At the present time there is substantial debate surrounding the conceptualization of critical cognitive skills and in the operational definition of "cognitive compensation skills". Additional work in these areas would further illuminate rehabilitation strategies for clients with cognitive impairments. Such work could have far-reaching impacts if viewed from a larger continuum of cognitive impairments, from women being served by TANF or job placement services, to juvenile justice settings, to populations being served in America's criminal justice system.

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TABLE 1

Selected Demographic/Background Characteristics of Participants in the Study

DEMOGRAPHIC CHARACTERISTIC	DESCRIPTIVE STATISTICS	GROUPS: (A) CAM – Outpatient (n = 117)	(B) Residential (N = 38)	(C) Total Sample (n = 155)
Gender	% Female	33.3%	32.4%	32.9%
	% Male	66.7%	67.6%	67.1%
Age	Mean	37.8 Yrs.	39.2 Yrs.	38.0 Yrs
	Standard Deviation	9.4	9.3	9.3
Race/Ethnicity	% White	56.9%	59.5%	57.8%
	% African-American	43.1%	40.5%	42.2%
	% Other Minority	0.0%	0.0%	0.0%
Education Level	% 12^{th} Grade or Less	43.6%	48.6%	45.2%
	% 12^{th} Grade or GED	37.6%	18.9%	32.9%
	%More Than 12^{th} Grade	18.8%	32.4%	21.9%

Table 2

Observed Levels of "Impairment" Across the 14 Selected Cognitive Criteria

COGNITIVE AREA	CRITERION VARIABLE	Normative %ile Used to Denote "Impaired"	Observed % of Study Participants Falling in the "Impaired" Range
Attention	Brief Test of Attention (BTA) Total Score	9th	40.0%
	Ruff 2 & 7 Test - Total Speed Score	10th	28.0%
	Ruff 2 & 7 Test - Total Accuracy Score	10th	21.3%
Executive Functioning	Trail Making Test - Part A Time	10th	34.9%
	Trail Making Test - Part B Time	10th	60.9%
	Revised Token Test - Total Score	9th	25.3%
	Ravens Progressive Matrices Test - Total Score	10th	24.5%
Memory	Rey Complex Figure Test (RCF) - Copy Score	10th	29.6%
	RCF - Immediate Recall Score	10th	58.1%
	RCF - Delayed Recall Score	10th	26.3%
	Rey Auditory Verbal Learning Test (RAVLT)		
	- Total Recall Score	10th	40.5%
	- Immediate Recall Score	10th	25.5%
	- Delayed Recall Score	10th	29.4%
	- Recognition Score	10th	2.6%

Cochran's Q Test = 231.99, which is significant at $\alpha = .0001$ level with df = 13.

Table 3

Observed Number of Cognitive Impairments by Number of Areas[1]

DEPENDENT VARIABLE	RESPONSE CATEGORIES	NUMBERS OF CASES OBSERVED BY CATEGORY*		TEST STATISTIC
Number of Cognitive Areas in Which an Impairment Was Observed	0 (No Impairments Noted)	11	(7.1%)	
	1 (Impairment in One Cognitive Area Only)	34	(21.9%)	**$X^2 = 240.1$**
	2 (Impairments in Two Cognitive Areas)	47	(30.3%)	**($p < .000$)**
	3 (Impairments in Three or More Cognitive Areas)	63	(40.6%)	

* The reported X^2-Value is based on the expected frequencies described in text (e.g., 70%, 10%, 10%, 10%).
[1] - attention, executive functioning, and memory areas

Table 4

"Pre" to "Post" Performance of "Control" and "Experimental" Subjects Across 14 Neurocognitive Measures/Criteria

COGNITIVE AREA	CRITERION VARIABLES	GROUP MEANS (Stan. Dev.): (A) CONTROL* Pretest	(A) CONTROL* Posttest	(B) EXPERIMENTAL* Pretest	(B) EXPERIMENTAL* Posttest
Attention	BTA Total Score	13.1(3.7)	13.5 (4.1)	12.9 (4.1)	13.6 (4.4)
	Ruff Speed Score	46.3 (11.5)	50.6 (12.7)	44.6 (13.5)	49.0 (13.9)
	Ruff Accuracy Score	47.3 (9.7)	47.0 (11.2)	47.0 (9.9)	45.5 (10.5)
Executive Functioning	Trails Part A Time	41.2 (21.4)	37.9 (17.8)	44.6 (30.2)	39.8 (25.5)
	Trails Part B Time	135.1 (91.0)	115.4 (62.5)	147.4 (116.6)	133.7 (110.8)
	Token Total Score	40.0 (4.3)	40.4 (4.2)	40.3 (4.4)	40.2 (4.5)
	Raven Total Score	27.2 (6.6)	27.9 (5.1)	27.9 (5.3)	28.1 (6.7)
Memory	RCF Copy Score	29.2 (7.3)	29.5 (7.2)	28.7 (8.3)	29.1 (8.1)
	RCF Immediate Recall	13.9 (7.8)	16.4 (9.8)	12.6 (7.6)	16.7 (9.9)
	RCF Delayed Recall	13.0 (8.4)	16.5 (9.5)	11.5 (8.0)	15.8 (10.2)
	RAVLT Total Recall	41.4 (10.3)	45.9 (12.5)	42.3 (11.1)	46.2 (12.7)
	RAVLT Immediate Recall	8.2 (3.20	9.1 (3.6)	7.9 (3.2)	9.2 (3.8)
	RAVLT Delayed Recall	8.1 (3.8)	8.6 (3.5)	8.0 (3.3)	9.4 (3.7)
	RAVLT Recognition	13.6 (1.8)	13.9 (1.4)	13l7 (1.8)	13.9 (1.8)

* The useable n's for this analysis were 28 for the Control Group and 57 for the Experimental Group.

Table 5

Results of the Multivariate, Mixed-Model Analysis*

TEST STATISTICS	CRITERION VARIABLES	STATISTICAL HYPOTHESES EVALUATED: (A) Experimental vs Control	(B) Pre vs. Post	(C) Interaction
Multivariate F		$F_{14,70} = 0.5$ (p = .905)	**$F_{14,70} = 3.4$ (p = .000)**	$F_{14,70} = 0.6$ (p = .878)
Univariate F's (Follow-Up)	BTA Total Score	F = 0.0 (p = .948)	F = 2.2 (p = .140)	F = 0.1 (p = .747)
	Ruff Speed Score	F = 0.3 (p = .578)	**F = 18.8 (p = .000)**	F = 0.0 (p = .974)
	Ruff Accuracy Score	F = 0.2 (p = .682)	F = 0.8 (p = .362)	F = 0.3 (p = .580)
	Trails Part A Time	F = 0.2 (p = .635)	F = 4.9 (p = .029)	F = 0.2 (p = .688)
	Trails Part B Time	F = 0.5 (p = .502)	F = 4.6 (p = .035)	F = 0.1 (p = .700)
	Token Total Score	F = 0.0 (p = .963)	F = 0.2 (p = .684)	F = 0.3 (p = .609)
	Raven Total Score	F = 0.1 (p = .725)	F = 0.5 (p = .483)	F = 0.2 (p = .652)
	RCF Copy Score	F = 0.1 (p = .798)	F = 0.4 (p = .507)	F = 0.0 (p = .964)
	RCF Immediate Recall	F = 0.1 (p = .794)	**F = 22.3 (p = .000)**	F = 1.3 (p = .261)
	RCF Delayed Recall	F = 0.4 (P = .553)	**F = 23.9 (p = .000)**	F = 0.3 (p = .603)
	RAVLT Total Recall	F = 0.1 (p = .820)	**F = 20.5 (p = .000)**	F = 0.1 (p = .743)
	RAVLT Immediate Recall	F = 0.0 (p = .870)	**F = 15.9 (p = .000)**	F = 0.4 (p = .572)
	RAVLT Delayed Recall	F = 0.2 (p = .665)	**F = 12.0 (p = .001)**	F = 3.4 (p = .071)
	RAVLT Recognition	F = 0.0 (p = .991)	F = 2.0 (p = .164)	F = 0.1 (p = .770)

* The useable n's for this analysis were 28 for the Control Group and 57 for the Experimental Group, and each of the **bolded F-Values** is significant at $\alpha = .001$ level.

Table 6

Selected Pre-Post Statistics on Variables of Interest

CLUSTER OR AREA	DEPENDENT VARIABLES	GROUP MEANS (Stand. Dev.) OR %AGE BY CATEGORY WHERE APPLICABLE			
		(A) CONTROL		(B) EXPERIMENTAL	
		Pretest	Posttest	Pretest	Posttest
Substance Use/ Abuse Indicators	Frequency of Use - Primary Drug	1.6 (1.9)	1.2 (1.9)	1.7 (1.7)	1.4 (1.7)
	# Days Used Alcohol in Last 30	2.3 (4.8)	1.7 (5.2)	1.8 (4.0)	1.4 (4.2)
	# Days Used Drugs in Last 30	2.3 (4.0)	0.9 (2.1)	1.4 (3.9)	3.4 (8.5)
	# Times Treated for Alcohol Problems in Last 9 Months	4.4 (11.3)	6.7 (15.4)	1.9 (3.2)	3.8 (6.4)
	# Times Treated for Drug Problems in Last 9 Months	5.5 (11.4)	5.8 (10.7)	2.0 (3.6)	3.2 (6.5)
	# Days Treated as Alcohol Outpatient in Last 30	2.3 (6.9)	6.9 (14.1)	6.2 (9.4)	7.3 (9.8)
	# Days treated as Drug Outpatient in Last 30	3.4 (7.2)	5.5 (7.9)	5.6 (10.1)	5.5 (9.4)
	ASI Alcohol Use Score	0.17 (0.17)	0.14 (0.12)	0.17 (0.15)	0.16 (0.13)
	ASI Drug Use Score	0.10 (0.07)	0.07 (0.04)	0.07 (0.06)	0.07 (0.06)
Psychiatric/ Other Variables	# ER Admits in Last 12 Months	0.5 (0.8)	0.5 (0.8)	0.8 (1.8)	0.6 (1.8)
	Brief Psychiatric Rating Scale Score	27.6 (6.5)	26.4 (7.2)	28.0 (6.9)	26.4 (6.8)
	Admitted to Hospital for AOD Problem in Last 9 Months?	0.2 (0.4)	0.2 (0.4)	0.0 (0.2)	0.2 (0.4)
	Satisfaction with Life Score	14.9 (7.6)	14.1 (7.3)	12.5 (4.9)	14.1 (4.9)
Therapists' Ratings of Subjects' Cognitive Skill Levels	Memory	2.5 (1.4)	2.3 (1.1)	2.8 (1.2)	2.6 (1.2)
	Attention	2.5 (1.3)	2.2 (1.0)	2.3 (1.1)	2.2 (1.2)
	Problem Solving	2.4 (1.2)	2.0 (1.0)	2.5 (1.2)	2.3 (1.4)
	Reasoning	2.3 (1.2)	1.9 (1.0)	2.2 (1.2)	2.0 (1.4)
Subjects' Ratings of Own Cognitive Skill Levels	Memory	3.3 (2.5)	2.7 (2.0)	3.7 (2.4)	2.6 (1.1)
	Attention	3.2 (2.5)	2.3 (2.1)	3.6 (2.5)	2.3 (1.1)
	Problem Solving	3.1 (2.5)	2.5 (2.1)	3.1 (2.7)	2.2 (1.2)
	Reasoning	2.7 (2.3)	2.3 (2.1)	3.0 (2.7)	2.0 (1.1)

Table 7

Results of Mixed Model Analyses for Hypothesis 3 Data

TEST STATISTICS	DEPENDENT VARIABLES	STATISTICAL HYPOTHESES EVALUATED* (A) Exper. vs. Control	(B) Pre vs. Post	(C) Interaction
Univariate F's	Frequency of Use - Primary Drug	$F_{1,73} = 0.1$ (p = .78)	**$F_{1,73} = 8.3$ (p = .01)**	$F_{1,73} = 0.3$ (p = .57)
	# Times Treated for Drug Problems in Last 9 Months	**$F_{1,62} = 4.4$ (p = .05)**	$F_{1,62} = 0.3$ (p = .61)	$F_{1,62} = 0.1$ (p = .72)
	ASI Alcohol Use Score	$F_{1,72} = 0.1$ (p = .76)	$F_{1,72} = 2.0$ (p = .16)	$F_{1,72} = 0.8$ (p = .37)
	ASI Drug Use Score	$F_{1,52} = 1.3$ (p = .27)	$F_{1,52} = 1.7$ (p = .20)	$F_{1,52} = 2.0$ (p = .16)
	Brief Psychiatric Rating Scale Score	$F_{1,91} = 0.0$ (p = .87)	**$F_{1,91} = 5.0$ (p = .03)**	$F_{1,91} = 0.1$ (p = .80)
	Admitted to Hospital for AOD Problem in Last 9 Months?	**$F_{1,46} = 2.6$ (p = .12)**	**$F_{1,46} = 1.1$ (p = .30)**	**$F_{1,46} = 1.1$ (p = .30)**
	Satisfaction with Life Score	$F_{1,47} = 0.6$ (p = .45)	$F_{1,47} = 0.1$ (p = .73)	$F_{1,47} = 1.6$ (p = .21)
Multivariate F's		**$F_{5,86} = 3.1$ (p = .01)**	$F_{5,86} = 1.5$ (p = ,20)	$F_{5,86} = 0.9$ (p = .49)
And Univariate F's (Follow-Ups) **Client Rating**	Memory	$F_{1,90} = 2.6$ (p = .11)	$F_{1,90} = 2.1$ (p = .16)	$F_{1,90} = 0.0$ (p = .83)
	Attention	$F_{1,90} = 0.4$ (p = .54)	$F_{1,90} = 2.6$ (p = .11)	$F_{1,90} = 0.3$ (p = .60)
	Problem Solving	$F_{1,90} = 1.2$ (p = .28)	$F_{1,90} = 2.6$ (p = .11)	$F_{1,90} = 0.2$ (p = .69)
	Reasoning	$F_{1,90} = 0.0$ (p = .98)	**$F_{1,90} = 5.1$ (p = .03)**	$F_{1,90} = 0.2$ (p = .65)
Multivariate F's		$F_{5,87} = 0.6$ (p = .69)	**$F_{5,87} = 3.2$ (p = .01)**	$F_{5,87} = 0.4$ (p = .87)
And Univariate F's (Follow-Ups) **Clinician Rating**	Memory	$F_{1,91} = 0.2$ (p = .67)	**$F_{1,91} = 8.0$ (p = .01)**	$F_{1,91} = 0.8$ (p = .38)
	Attention	$F_{1,91} = 0.3$ (p = .57)	**$F_{1,91} = 13.1$ (p = .00)**	$F_{1,91} = 0.4$ (p = .55)
	Problem Solving	$F_{1,91} = 0.1$ (p = .70)	**$F_{1,91} = 5.5$ (p = .02)**	$F_{1,91} = 0.2$ (p = .70)
	Reasoning	$F_{1,91} = 0.0$ (p = .99)	**$F_{1,91} = 4.3$ (p = .04)**	$F_{1,91} = 0.5$ (p = .47)
Chi-Square	Disposition - Goals Met (Yes or No)	$X^2_1 = 2.4$ (p = .12)	---	---

*Test Statistics with a p-value less than or equal to .05 are bolded and no attempt is made to control α experiment wide, therefore, the tests shown are as "liberal" as possible.

Other Publications To Date

Ronicker, B.M., Moore, D.C., & Allen, J.B. (2003). *Cognitive Enhancement Skills Training Manual*. SARDI-Wright State University School of Medicine. Dayton, Ohio. 250 p.

Allen, J. B., Moore, D., & Sample, E. B. (1999). Relationship between substance abuse severity indicators and cognitive performance in a dual-diagnosis population. *Journal of Neuropsychiatry and Clinical Neurosciences, 11,* 126-164.

Moore, D.C., & Allen, J.B. (in preparation). A pilot study of cognitive compensation skills training for persons with dual diagnoses.

Paper Presentations of the Research to Date

Moore, D. (2003, July). Do functional impairments persist in recovery? *Drug-free Workforce Conference*, U.S. Department of Labor, Washington, D.C.

Allen, J. & Moore, D. (2003, November). Cognitive Compensation Skills Training For Dual Diagnosed Persons, ODMH Research Results Conference, Columbus, OH

Moore, D. (2003, November). Preventing and treating substance abuse in people with disabilities. *A Select Summit on Disability and Health: A Call to Action*. Iowa Department of Health. Des Moines, IA

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