Journal of Rehabilitation
2006, Volume 72, No. 4, 31-39

Differential Performance of Job Skills in Schizophrenia: An Experimental Analysis

Alex Kopelowicz
David Geffen School of Medicine at UCLA

Fabian Aguirre
David Geffen School of Medicine at UCLA

Robert Paul Liberman
David Geffen School of Medicine at UCLA

Jim Mintz
David Geffen School of Medicine at UCLA

Charles J. Wallace
David Geffen School of Medicine at UCLA

One approach to improving competitive employment rates among persons with schizophrenia is to match people to jobs that fit their work abilities. In this study, 120 stable outpatients with schizophrenia were randomized to receive work skills training or occupational therapy and tested on 3 measures of entry level work skills. Participants who received training on the work tasks performed better than their counterparts who received occupational therapy, with the most robust differences noted on the task that least burdened verbal learning and memory. The results of this study suggest that one predictor of individuals' vocational success is the cognitive demands of the work tasks.

Competitive employment is increasingly a goal for people with serious mental illness since it confers a key normative role to individuals in their efforts to achieve community integration, empowerment and recovery (Bond, et al., 2001; Liberman & Kopelowicz, 2005). However, estimated rates of competitive employment among individuals with schizophrenia range from 10-20% (Cook et al., 2005; Mueser, Salyers, & Mueser, 2001). Although supported employment has been successful in helping up to 40% of individuals with schizophrenia obtain competitive employment (Cook & Razzano, 2000; Lehman et al., 2002), half of them experience job terminations within the first six months of employment (McHugo, Drake, & Becker, 1998). Because the problem of early job termination is better described than understood, a priority for research in vocational rehabilitation of persons with schizophrenia is to identify the factors that impede job maintenance. Knowledge of those factors that are obstacles to employment is critical to designing improved methods of vocational rehabilitation for persons with schizophrenia.

In general, barriers to sustained success at work are inherent in the mismatch between an individual's attributes, deficits, skills and interests on the one hand, and the properties, expectancies and requirements of the job on the other. One characteristic of individuals with schizophrenia that is relevant to successful person-job fit is deficiencies in cognitive capacities (Gold et al., 2002; McGurk & Mueser, 2003). Impaired cognition causes difficulties for persons with schizophrenia in performing many tasks that are found in the workplace. Moreover, well-replicated research has revealed a strong association between cognitive functions and success of schizophrenia patients on a wide variety of instrumental role activities including employment, social skills and social functioning (Green, Kern, Braff, & Mintz, 2000).

The purpose of this study was to determine if the individuals' vocational success might be a function of the cognitive "demands" imposed by typical entry-level job tasks. Three such tasks were used in this study. One involved learning how to select and serially insert parts into a computer motherboard, which emphasizes visual-spatial memory skills; another involved sorting written material alphabetically and categorically, which makes a strong demand on verbal working memory; and the third involved learning the basic procedures of word processing using a personal computer, which taps verbal learning ability (Kern et al., 2002; Zarate, Liberman, Mintz, & Massel, 1998). The hypotheses were that clients would perform better on tasks that required less demands on verbal learning and memory, and that participants who received occupational therapy would do more poorly on the tasks than their counterparts who received specialized training for the tasks.

Alex Kopelowicz, MD, San Fernando Mental Health Center, 10605 Balboa Blvd., Suite 100, Granada Hills, CA 91344.
Email: akopel@ucla.edu

Methods

Design

The three disparate entry-level work tasks were designed to be representative of entry-level jobs available in the community (Zarate, Liberman, Mintz, & Massel, 1998). Occupational Therapy (OT) was chosen as a comparative method because it was conducted in a manner to give structured opportunities for participants to improve their task-oriented attention, concentration and learning capacities and to give occupational therapists the occasion to prompt and reinforce participants for improved cognitive functioning and task productivity. In addition, OT was designed to serve as a control for the amount of interpersonal contact between participants and therapists. The same certified occupational therapists conducted both Work Training (WT) and OT in groups of 4-6 individuals.

All participants performed each task, and they were evaluated on accuracy and productivity at baseline, immediately before training commenced 4 weeks later (week 4), and at weeks 12 and 24. Participants were randomly assigned to WT that consisted of training on each task over a two-week period or to OT that focused on crafts and other creative activities for the same time as participants in the WT condition. As a fidelity check on the training intervention, that is, to assure that the training designed to improve the targeted skills did in fact do so, participants assigned to WT were assessed for task performance immediately after their two-week training period.

Participants were also randomly assigned to two medication conditions – equipotent risperidone or olanzapine – to determine whether there were any differences between these antipsychotic drugs on the participants' performance on the work tasks. The results of the pharmacological arm of the study on drug-task interactions will be reported in a subsequent publication. For purposes of this study, the participants in both medication conditions were combined for analyses.

Participants

The study group consisted of 120 participants with the clinical diagnosis made by the participants' attending psychiatrist of DSM-IV-TR schizophrenia or schizoaffective disorder. The diagnosis was confirmed using the Structured Clinical Interview for DSM-IV (First, Spitzer, Gibbon, & Williams, 1996) by an interviewer trained to a high level of reliability (.90) at the UCLA Clinical Research Center for Schizophrenia. The 24-item, expanded version of the Brief Psychiatric Rating Scale (Ventura, Green, Shaner, & Liberman, 1993) was administered at the baseline assessment for evaluating participants' psychopathology during the 2 weeks prior to study entry. The Schedule for the Deficit Syndrome (Kirkpatrick, Buchanan, McKenney, Alphs, & Carpenter, 1989) and the Clinical Global Impression scale (Guy, 1976) were also administered at baseline.

Participants were receiving outpatient treatment at a community mental health center in north Los Angeles County. Participants met the following criteria: (a) DSM-IV-TR diagnosis of either schizophrenia or schizoaffective disorder, (b) not meeting criteria for the deficit syndrome, (c) no alcohol or substance abuse or dependence within past three months, (d) no psychiatric inpatient treatment within the past six months, (e) a resident of Los Angeles County for at least the previous six months, (f) between 18 and 64 years of age, and (g) no history of neurological disorder apart from schizophrenia. These criteria were designed to select participants who needed maintenance antipsychotic medications but who were clinically stable. Stability was defined as no psychiatric hospitalizations or change in antipsychotic medications (either type or dose) for the past 3 months. These inclusion criteria were used to approximate the clinical characteristics of clients eligible for referral to work programs at the mental health center.

After completely describing the study to the participants, informed consent was obtained if the participant was able to accurately repeat back the primary elements of the informed consent document. Participants were then randomly assigned to the OT or WT groups; table 1 presents the demographic and clinical characteristics for the groups. Participants received $10.00 per hour for project participation, including the diagnostic and symptom assessments.

Procedure

After the assessment measures were administered at baseline, participants were tapered off their previous antipsychotic medication (see Table 1 for baseline medications) for a 2 day period. Participants were further randomized to receive either olanzapine or risperidone, with titration determined by the treating psychiatrist. Both the participant and the psychiatrist were informed as to which medication the participant had been randomized to receive. The prescribing psychiatrist had latitude in prescribing varying amounts of the medication within a range of 5-20 mg/day olanzapine and 2-8 mg/day of risperidone. Optimum dosage was determined by the treating psychiatrist based on his/her best judgment of a balance between maximizing symptom control and minimizing side effects. The mean dose at study end for participants assigned to olanzapine was 15.7 ± 3.4 mg and risperidone was 3.7 ± 1.8 mg.

After four weeks of treatment with either risperidone or olanzapine, the OT and WT groups were implemented. Both consisted of six 60-minute sessions conducted over a period of two weeks. After the completion of training, participants were not provided with opportunities to practice what they learned on the three tasks, although there was no attempt to control or measure participants' subsequent exposure to the job tasks (e.g., accessing a computer at home to try out newly learned word processing skills).

Occupational Therapy

The six OT sessions were conducted as group meetings to match the schedule and duration of the WT sessions and followed a format and focus similar to the OT utilized in previous projects (Liberman, et al., 1998; Tauber, Wallace, & Lecomte, 2000). Specifically, OT patients participated in expressive, creative and artistic activities with therapeutic feedback, encouragement and practice aimed to enhance individuals' attention span, independence of effort, sustained performance, self-esteem, assertiveness,

socialization, and group participation. The creative activities included drawing, painting, sculpture and beadwork.

Work Tasks

Index card filing. As shown in Figure 1, the task involved filing 20-card piles of index cards. Once participants completed a 20-card pile, a new pile was placed before them. Participants were told that each card contained information about a person who had purchased a car. Each card contained the city of purchase, car manufacturer, and owner's last name printed in large (20-point), boldface type (Arial font). Participants were instructed to file the cards into boxes according to the city of purchase, car manufacturer, the alphabetical section for the owner's last name (e.g., A-F, G-L), and alphabetical order according to the owner's last name. Participants were given 1 point for each correct component (i.e., correct city, correct car, correct alphabet section, and correct alphabet order) for each card, thus enabling them to earn 4 points for each card done correctly. The dependent variable was the total number of points earned in 15 minutes of card sorting up to a maximum of 360. This task has good social and construct validity and the scoring method has been shown to be reliable (Kern, Liberman, Kopelowicz, Mintz & Green, 2002; Zarate, Liberman, Mintz, & Massel, 1998).

Computer board assembly. As shown in Figure 2, the task involved the assembly of a Socket A computer motherboard. The various computer parts were scattered around a table and included target items (i.e., parts expected to be placed on the motherboard) and Distracters (i.e., parts that look similar to the target items but were not labeled on the poster board). The target items included four yellow AGP Graphics Cards, four green PCI Modems, four DDR Memory, four SD Memory, three brown Athlon CPU processors, and four green PCI Graphics Cards. The distracters included one green AGP Graphics Card, two green 4-slot USB PCI Cards, four yellow 2-slot USB PCI Cards, one green Ethernet Card, one green Intel CPU processor, one Enhanced IDE Disk Controller, six connection belts, two cooling fans, one panel, one CD-ROM Drive, and two small screwdrivers.

The participants were told to refer to a poster board that listed the target items and informed them where on the motherboard each item belonged. If the participant completed the assembly of one motherboard, they were given another to work on, up to a total of three. Participant received 1 point for correctly assembling the AGP Graphics card, the PCI Modem, and the PCI Graphic card and 2 points for the DDR Memory, the SD Memory, and the Athlon CPU (the 2 point items were scored for correct location and for fully latching the part). In addition, 1 point was awarded for assembling the motherboard in the order listed on the poster board. The dependent measure was the total number of points earned in 15 minutes of computer assembly with a maximum score of 30. Formal evaluation of the psychometric properties of this measure has yet to be conducted.

Table 1

Demographic and Clinical Characteristics of Participants

	Training Group			
	Work Training n = 60		**Occupational Training n = 60**	
Characteristics				
Demographic				
	N	*%*	*N*	*%*
Gender				
Male	43	72%	39	65%
Female	17	28%	21	35%
Ethnicity				
African American	5	8%	6	10%
Asian	2	3%	2	3%
Hispanic	24	40%	31	52%
Caucasian	29	48%	21	35%
Marital Status				
Never married	49	82%	44	73%
Employment				
Unemployed	54	90%	45	75%
Cigarette smokers	38	63%	35	58%
	Mean	*SD*	*Mean*	*SD*
Age	37.0	11.5	36.6	11.4
Years of Education	11.1	3.1	10.8	3.3
Clinical				
	N	*%*	*N*	*%*
Baseline Antipsychotics				
Conventional	30	50%	28	47%
Quetiapine	12	20%	10	17%
Ziprasidone	6	10%	7	12%
Aripiprazole	4	7%	6	10%
Risperidone	5	8%	4	7%
Olanzapine	3	5%	5	8%
	Mean	*SD*	*Mean*	*SD*
Illness Chronicity, in years	13.5	6.4	14.2	7.0
BPRS[1] Positive Symptoms	61.2	26.1	58.3	24.7
CGI-S[2]	4.4	0.49	4.4	0.74

[1] Brief Psychiatric Rating Scale items rated "1" (symptom is not observed) to "7" (symptom is very severe).

[2] Clinical Global Impression-Severity scale rated "1" (not at all ill) to "7" (extremely severe).

Computer use. A 52 question, multiple-choice test assessed computer knowledge in four separate areas: identifying basic computer hardware, editing text, formatting text, and using a printer. Because responding to a written questionnaire may assess cognitive skills (e.g., reading comprehension) that may be very different from the skills tapped in an evaluation of performance on computer tasks, the test of computer knowledge was designed to carefully mimic participants' actual performance. For example, the test included a diagram of a computer tower with several disk drives and alternative types of disks (3.5 inch disk or CD-ROM disk). Participants were asked to indicate which disk should be inserted into which disk drive. On other questions, participants were prompted to refer to an image of a computer screen simulating the operation of Microsoft Word. Their task was to identify the button on the image's task bar that corresponded to one of several actions (e.g., cut text, paste text, italicize, etc.). Participants were given the test in a quiet environment and had 30 minutes to complete it. Each correct answer received 1 point as a measure of performance. The dependent measure was the total number of points with the maximum being a score of 52. Formal evaluation of the psychometric properties of this measure has yet to be conducted.

Figure 1. Index Card Filing Task

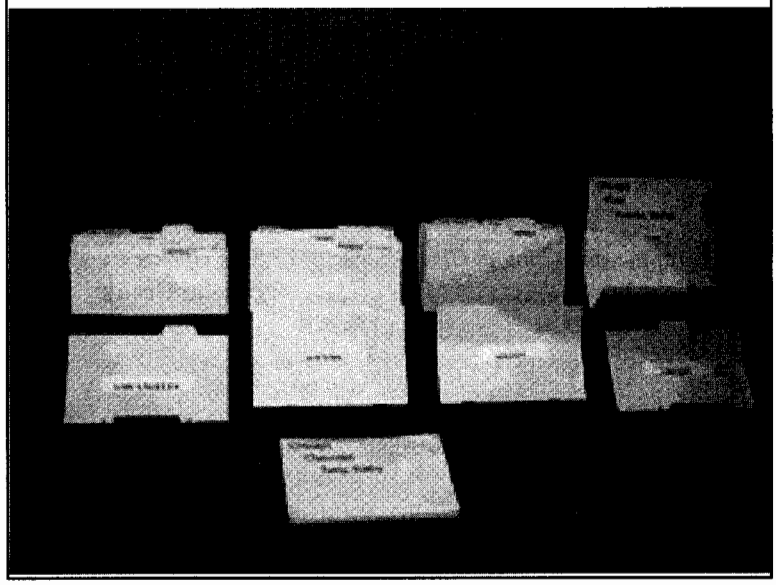
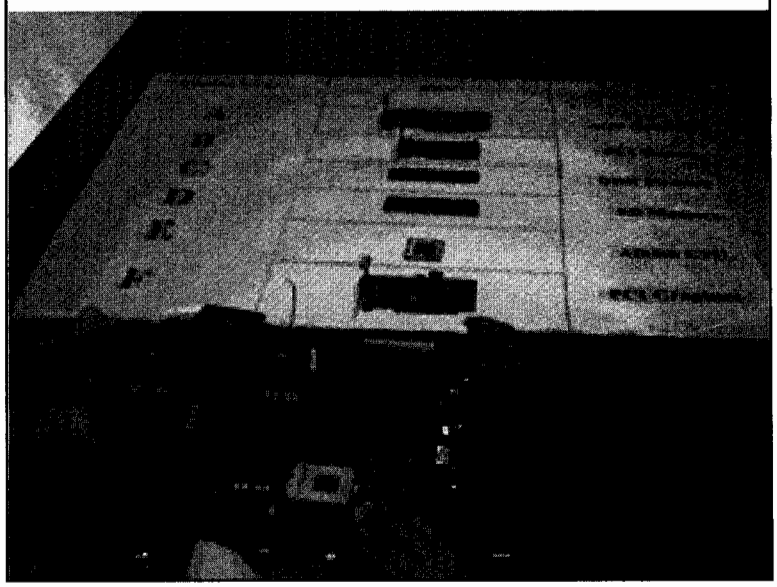


Figure 2. Computer Assembly Task



Training Methods

Therapists utilized basic principles of learning in the training of the three work tasks. These included providing specific instructions, demonstration of the skill to be learned, prompting and coaching, shaping, corrective feedback and contingent positive reinforcement. The specific details of each training program are described below.

Index card filing. Training on the index card-filing task consisted of 1 hour of individualized training with a 15-minute break. During the training session, the trainer provided clear verbal instructions on how to perform the task and demonstrated the correct placement of the index cards with 10 sample cards. The participant was given 60 cards to file correctly. Twice throughout the task, the trainer reviewed the filed cards and gave feedback to the participant while correcting misplaced cards. For each misfiled card, the trainer instructed the participant on the correct placement of the card and supervised the participant's placement of the next three cards to ensure that the participant learned the correct procedure.

Computer assembly. Training on the computer assembly task consisted of 1 hour of individualized training with a 15-minute break. During the training session, the trainer explained the physical features and proper location of each computer component. There were three parts in this training. First, the trainer taught the participant to name, describe and place each component in its proper place on the motherboard. Second, as the participant attempted to place each computer part, the trainer assisted by giving feedback and actively correcting any mistakes. Third, the participant identified the correct order in which each computer part was to be placed on the motherboard with feedback provided after the task.

Computer use. Training on computer use consisted of four sessions given over a span of 2 days with one trainer for every 2 participants. Training sessions lasted approximately 1 hour each with a 15-minute break within each session and a 30-minute break between sessions. The first session was focused on learning the names of the basic computer hardware components and their respective functions. The second lesson addressed how to select, delete, replace, add, copy, and move text using Microsoft Word 2000. The third lesson emphasized more advanced Microsoft Word skills, including how to format text and paragraphs.

The fourth lesson highlighted the use of the printer, demonstrating how to print documents as well as the various printing options available. The trainers worked from a teaching manual that was developed specifically for this project and the participants were provided with a workbook that allowed them to follow along and included hands-on exercises to ensure their grasp of the

material. The trainers conducted the lessons in an interactive fashion, pausing to ask questions, demonstrating the material for each participant (rather than just present the material didactically) and assessing comprehension by asking participants to demonstrate their newly learned skills in class. The lesson plans for each of the four sessions is available from the first author.

Data Analysis

Contrasts were conducted on demographic, chronicity, symptom and treatment measures at baseline to examine possible group differences prior to the time of training and to identify correlations between these factors and performance on the work tasks. An intent-to-treat analysis was employed for each of the dependent measures, using all participants randomized to a condition regardless of degree of participation as long as there were two assessment points (at baseline and at least one other timepoint). The data were analyzed for each of the three dependent measures (i.e., change from baseline on each work task) with a mixed model factorial ANCOVA using SAS/STAT Version 9 (SAS Institute, 2004) with one between-subjects variable, training group (WT versus OT), and one within-subjects variable, time of testing (week 4: immediately before WT or OT training; week 12: 6 weeks after training; week 24: 18 weeks after training). The Week 12 and Week 24 assessments were relied on to serve as outcome measures rather than the assessment at Week 6 because the former timepoints more accurately reflect real-world conditions in that employees are expected to retain what they learn in a work setting for weeks and months after the initial job training. The scores on each measure at baseline (pretest before randomization to medication condition) served as the covariate for the ANCOVA of that measure. An unstructured covariance matrix was specified. Follow-up between- and within-group contrasts were conducted on all significant main (i.e., group, time) and interaction (i.e., group x time) effects with baseline scores as covariates.

Results

No significant differences were found between WT and OT groups at baseline for illness, treatment, or demographic characteristics (see Table 1). There were no statistically significant correlations between any of these baseline characteristics and work task performance except for age with the computer assembly task ($p = .005$). Specifically, younger participants performed better than older participants at the rate of 0.18 SD for every year of age difference.

There were no significant differences in dropouts between the two groups; over the 24 weeks of the study, there were 13 and 12 dropouts for the OT and WT groups, respectively. All participants who participated in at least one WT or OT session received all six training sessions. The results for learning and retention of the three job tasks are presented in Table 2 and Figure 3 and described below.

Computer Assembly Task

Participants assigned to WT, but not OT, demonstrated excellent learning and retention of computer assembly skills, improving from a mean score of approximately 15% correct at baseline to almost 90% correct immediately after training, with a modest fall off to 66% correct 18 weeks after training (effect size of change from baseline to final assessment: Cohen's $d = 1.54$). Between group comparisons showed no statistical differences between participants assigned to WT versus OT at baseline. However, at both Week 12 and at Week 24, the WT group demonstrated better performance than the OT group.

Computer Knowledge Test

For the test of computer knowledge, participants assigned to WT learned and retained the material, improving their computer knowledge from 54% correct at baseline to 64% correct immediately after training, but with a fall off to 60% correct at the follow-up assessment (effect size of change from baseline to final assessment: Cohen's $d = .29$). Between group comparisons showed no statistical differences between participants assigned to WT versus OT at baseline, but at Week 12 and Week 24, the WT group demonstrated better performance than the OT group.

Index Card Filing Task

For the index card filing task, participants assigned to WT learned the skill, improving from scores of 39% correct at baseline to 52% immediately after training, but displayed considerable drop-off in skill retention over time with scores returning to 43% correct by the follow-up assessment (effect size of change from baseline to final assessment: Cohen's $d = .35$). OT participants demonstrated gains in index card filing performance comparable to that of the WT group at both follow-up assessment points. Between group comparisons showed no statistical differences between participants assigned to WT versus OT at baseline, at Week 12 or at Week 24, although the groups were significantly different at Week 4 immediately prior to training.

Discussion

The present study examined the ability of clinically stable outpatients with schizophrenia to learn three different entry-level work tasks. The results suggested that their performance on the three tasks might have reflected the different cognitive demands imposed by each of the tasks. On the task that least burdened verbal learning and memory, computer assembly, participants in the WT condition demonstrated excellent learning and retention. In contrast, on the tasks that taxed verbal learning and memory, index card filing and computer knowledge, participants in the WT condition demonstrated less robust learning than on the computer assembly task as well as a fall off in performance at the follow up assessments. Moreover, on the index card filing task participants in the WT condition did not perform better than participants in the OT group.

The results of this study seem consonant with the finding that among neurocognitive deficits associated with schizophrenia; disturbances in verbal memory and verbal learning are disproportionately large (Heinrichs & Zakzanis, 1998). In addition, the results are consistent with neurocognitive studies that have revealed implicit or procedural learning of persons with schizophrenia, as is used in visually based "routines" similar to those involved in the computer assembly task, is comparable to normal

controls (Clare, McKenna, Mortimer, & Baddeley, 1993). In one such study that used an errorless learning approach, Kern et al. (2002) taught work-like tasks to persons with schizophrenia by minimizing demands on verbal memory, relying instead on the relatively intact implicit memory system (Danion, Meulemans, Kauffmann-Muller, & Vermaath, 2001). These results suggest that placing individuals with schizophrenia in jobs that are more procedurally based may lead to better learning and durability of task performance and perhaps vocational success. Of course, job success for any particular individual will be a function of myriad variables, only a few of which are related to cognitive functioning. Although the data are not available from this study, a possible hypothesis is that jobs that tax individuals' cognitive deficits in verbal learning and memory will likely lead to failure in many persons with schizophrenia while those that require individuals' cognitive strengths have a greater probability of leading to success.

Matching persons with schizophrenia to jobs that are consistent with their abilities and do not challenge their deficits has been shown to yield favorable results in supported employment for persons with serious mental illness. In that modality, job coaches

Table 2.
Scores on work tasks at all time points over 6 months for subjects in each of the two training conditions, Work Training (WT) and Occupational Therapy (OT)

		Baseline[1] n =120 Mean (SD)	**Week 4**[2] n = 114 Mean (SD)	**Week 6**[3] n = 56 Mean (SD)	**Week 12**[4] n = 106 Mean (SD)	**Week 24**[5] n = 95 Mean (SD)
Computer Assembly Task[a] (highest possible score = 30)	WT	5.5 (7.7)	6.6 (8.7)	26.9 (4.1)	16.7 (9.8)	19.9 (9.3)
	OT	4.6 (8.0)	5.5 (8.5)		6.2 (8.9)	5.7 (9.1)
Computer Knowledge Task[b] (highest possible score = 52)	WT	28.3 (9.4)	28.7 (9.4)	33.4 (8.8)	30.5 (8.9)	31.1 (9.5)
	OT	26.5 (11.1	25.7 (12.1)		25.8 (11.6)	25.5 (11.2)
Index Card Filing Task[c] (highest possible score = 360)	WT	140.2 (62.5)	152.6 (63.6)	187.9 (68.8)	155.1 (69.6)	156.4 (74.2)
	OT	118.9 (64.3)	127.3 (61.3)		139.4 (73.3)	142.0 (71.9)

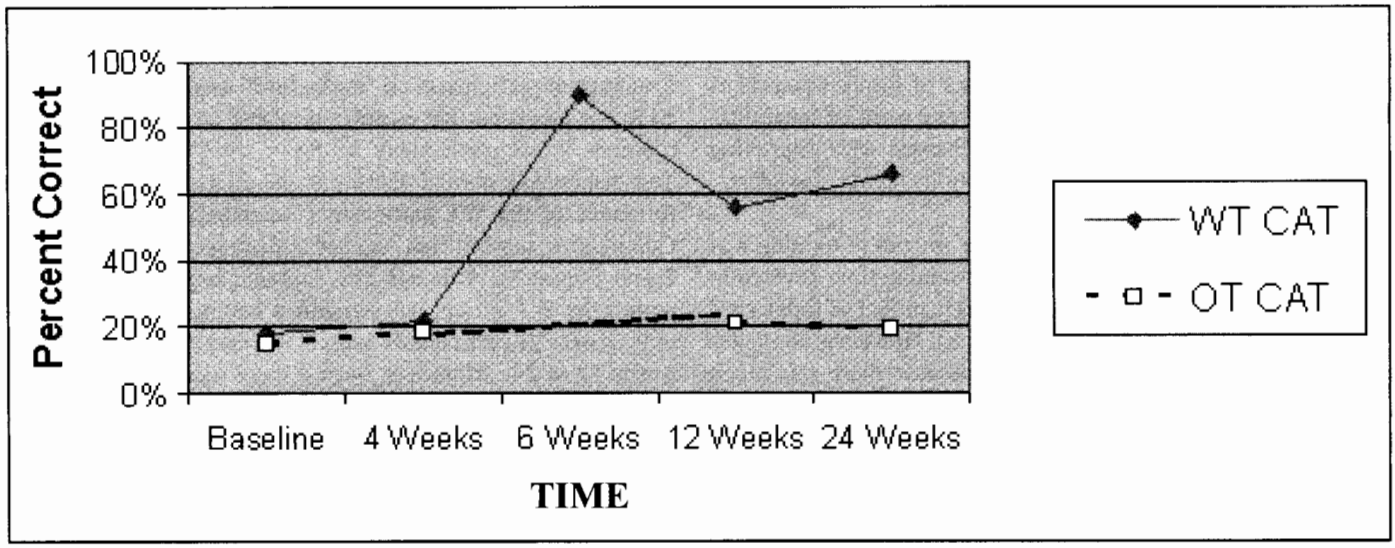
1. Baseline: Before randomization to medication condition (olanzapine vs. risperidone)
2. Week 4: Before commencement of training groups (work training vs. occupational therapy)
3. Week 6: Post-test conducted immediately after two weeks of training (WT group only)
4. Week 12: Six weeks after the completion of training
5. Week 24: Eighteen weeks after the completion of training

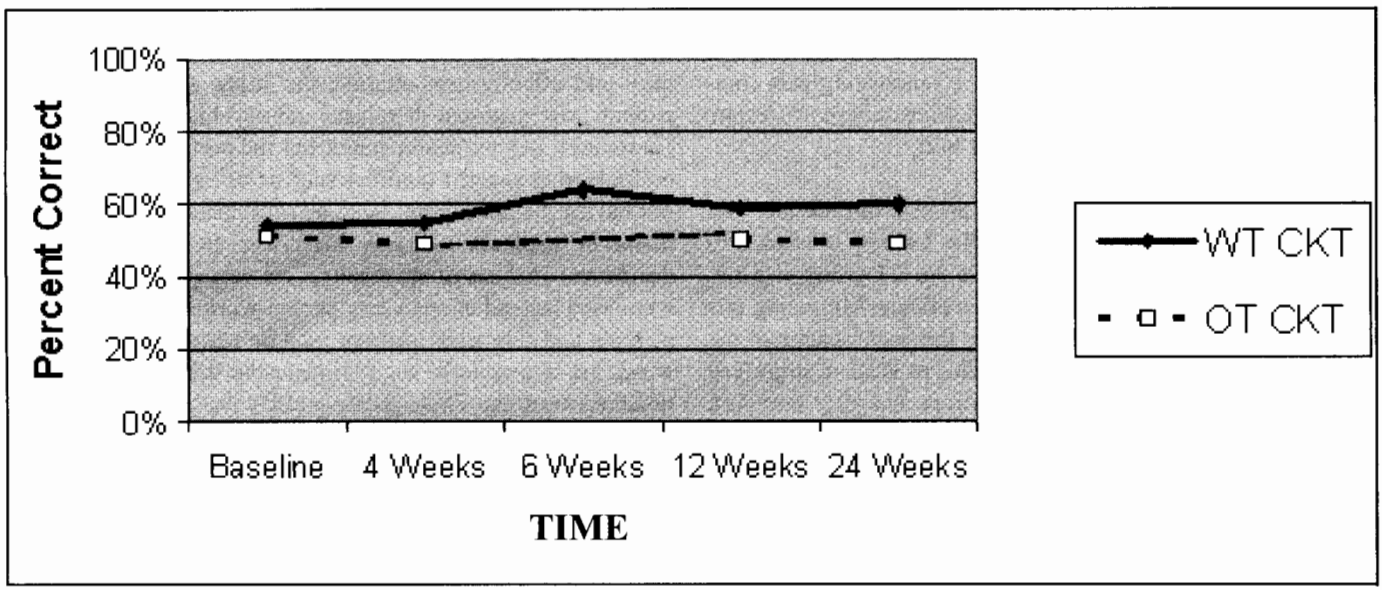
a. Significant effect of group ($F = 44.4$, $df = 1, 111$, $p < .0001$), time ($F = 47.0$, $df = 2, 111$, $p < .0001$), and group x time interaction
($F = 32.3$, $df = 2, 111$, $p < .0001$).
Within group: WT (Week 6 vs. Baseline: $t = 39.9$, $df = 54$, $p < .0001$; Week 12 vs. Baseline: $t = 9.8$, $df = 52$, $p < .0001$; Week 24 vs. Baseline: $t = 11.8$, $df = 46$, $p < .0001$), OT (Week 12 vs. Baseline: $t = .63$, $df = 50$, $p = .53$; Week 24 vs. Baseline: $t = .07$, $df = 45$, $p = .94$).
Between group: WT vs OT (Baseline: $t = .64$, $df = 118$, $p = .52$; Week 4: $t = .68$, $df = 112$, $p = .50$; Week 12: $t = 5.81$, $df = 104$, $p < .0001$; Week 24: $t = 7.51$, $df = 93$, $p < .0001$).

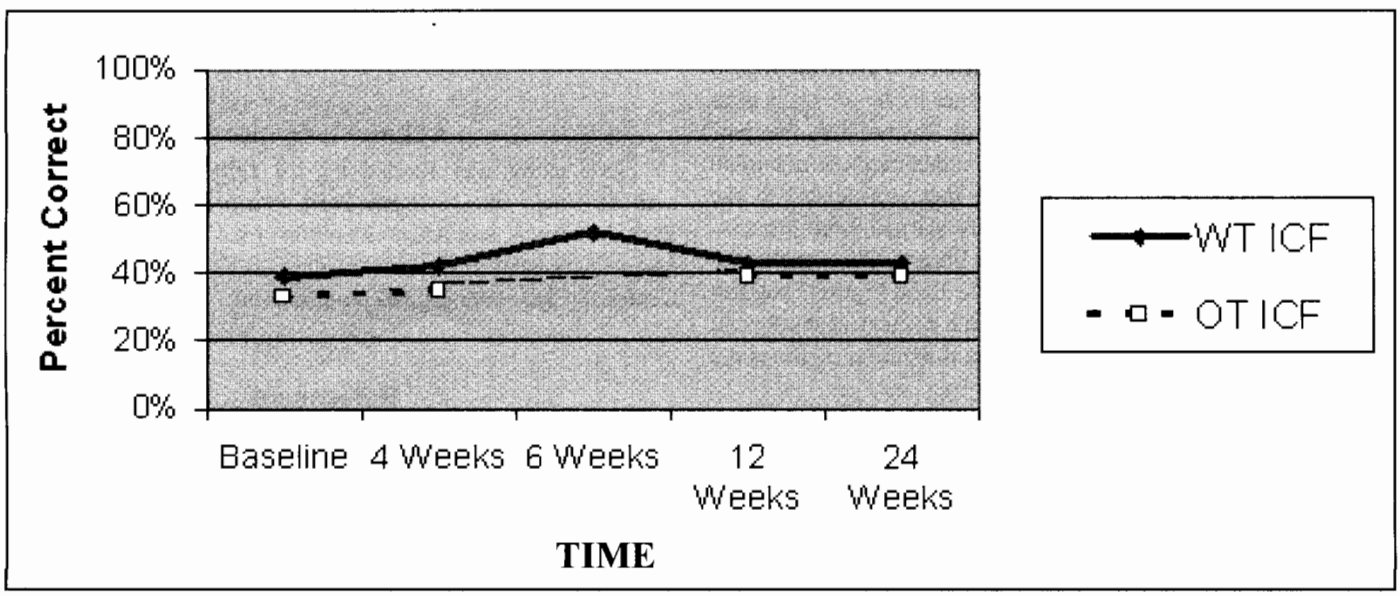
b. Significant effect of group ($F = 5.12$, $df = 1, 111$, $p < .05$), and time ($F = 3.91$, $df = 2, 111$, $p < .05$), but no interaction effects.
Within group: WT (Week 6 vs. Baseline: $t = 6.61$, $df = 54$, $p < .0001$; Week 12 vs. Baseline: $t = 3.41$, $df = 52$, $p < .005$; Week 24 vs. Baseline: $t = 2.88$, $df = 46$, $p < .01$), OT (Week 12 vs. Baseline: $t = .84$, $df = 50$, $p = .40$; Week 24 vs. Baseline: $t = .22$, $df = 45$, $p = .83$).
Between group: WT vs OT (Baseline $t = .97$, $df = 118$, $p = .34$; Week 4: $t = 1.44$, $df = 112$, $p = .15$; Week 12: $t = 2.33$, $df = 104$, $p < .05$; Week 24: $t = 2.66$, $df = 93$, $p < .01$).

c. No significant main effects: group ($F = .37$, $df = 1, 111$, $p = .54$), time ($F = 1.20$, $df = 2, 111$, $p = .31$), or interactions.
Within group: WT (Week 6 vs. Baseline: $t = 6.61$, $df = 54$, $p < .0001$; Week 12 vs. Baseline: $t = 2.63$, $df = 52$, $p < .05$; Week 24 vs. Baseline: $t = 1.92$, $df = 46$, $p = .06$), OT (Week 12 vs. Baseline: $t = 3.21$, $df = 50$, $p < .005$; Week 24 vs. Baseline: $t = 2.87$, $df = 45$, $p < .01$).
Between group: WT vs OT (Baseline: $t = 1.83$, $df = 117$, $p = .07$; Week 4: $t = 2.16$, $df = 111$, $p < .05$; Week 12: $t = 1.13$, $df = 103$, $p = .26$; Week 24: $t = .96$, $df = 93$, $p = .34$).

Figure 3.
Performance among Computer Assembly Task (CAT), Computer Knowledge Test (CKT), and Index Card Filing (ICF), using Work Training (WT) or Occupational Therapy (OT) across time.







place individuals in jobs that play to their strengths and preferences and accommodate to their deficits (Becker & Drake, 2003). For example, a person with persistent problems with poor hygiene and grooming may be able to perform adequately in a job at a recycling plant where dirt and odors are omnipresent. Identifying those attributes of a job and a person with schizophrenia that make employability more likely is a fruitful area of future research as well as a guiding principle for the day-to-day work of rehabilitation counselors and other professionals charged with improving the level of functioning of people with serious mental disorders.

One limitation of this study is that the amount of training was not equivalent across the three tasks. The training time devoted to computer knowledge was longer (4 hours) than that of index card filing and computer assembly (1 hour each). However, computer knowledge training required more time because there was much more material to cover; namely, four separate lessons focused on distinct computer use skills. Each of these lessons received the same amount of time as the other two tasks (1 hour each). Moreover, participants learned the material from each of the four lessons at the same rate (approximately 15-20% improvement) which was less than the rate of learning on the computer assembly task (over 300% improvement) and similar to the learning rate on the index card task (22% improvement) indicating that computer knowledge was not learned disproportionately more despite the increased amount of training devoted to it.

A possible methodological concern arises from the fact that the WT group was tested immediately after training at week 6 to ascertain the fidelity of the training, while the OT group was not, thus introducing the possibility of practice effects. Mitigating this concern is the fact that on all three tasks, the performance of the WT group changed minimally from baseline to Week 4, improved from Week 4 to Week 6 (immediately before and after training), and declined from Week 6 to Week 12 and 24. In contrast, if practice would have played an important role, it was expected to see its effects demonstrated as continuous improvement on work skills over time, which was not observed (see Table 2 and Figure 3). This shows that the practice that occurred during the 2 weeks of training dwarfed the effect of one additional assessment.

A related methodological issue is that there was no attempt to control or measure the participants' exposure to the job tasks after completion of the training period. Although it is unlikely that participants independently attempted to file index cards or assemble a computer motherboard, it is possible that subsequent to the training they wished to try out their newly learned word processing skills at home or at the local public library. Once again, the pattern of skill learning illustrated in Table 2 and Figure 3 suggest that the bulk of the learning occurred in the context of the formal training sessions, not through impromptu utilization of the skills outside of class.

Another limitation of this study is that two of the instruments used to assess work skills have not been tested psychometrically. Unfortunately, the field suffers from a paucity of psychometrically validated instruments designed to measure performance on entry-level job skills for individuals with serious mental disorders. One such instrument, the Index Card Filing task (Kern et al., 2002; Zarate et al., 1998), and two newly developed assessment tools, the Computer Assembly Task and the Computer Knowledge Test, were used to evaluate other work domains that represent typical entry level job opportunities for people with serious mental disorders. Because the focus of this study was to examine the performance of participants on "real-world" work tasks, it was decided to use measures that closely simulated an ordinary work environment. While participants' scores on the Computer Knowledge Test displayed a normal distribution at all assessment points, performance of the WT participants immediately after training on Computer Assembly Task reached a mean score of 90% (see Table 2 and Figure 3). Although the dramatic improvement observed within the WT group may suggest a ceiling effect on this task, only 3 of 120 participants scored the maximum score of 30 at weeks 12 or 24. Moreover, even if there were a ceiling phenomenon, the effect would be to make the results (i.e., better learning of this task) even more impressive. Nevertheless, this is the initial process of psychometrically validating the Computer Assembly Task and the Computer Knowledge Test on a sample of 500 adults with serious mentally illnesses.

The present research represents a compromise between efficacy and effectiveness studies; the study was carried out with patients, occupational therapists and psychiatrists from a typical community mental health center but the participants were selected for having specific qualities such as being clinically stable and not having co-morbidities such as substance abuse, mental retardation or medical conditions. Moreover, the strategy used in the design and analysis of the results were very gross in that averages were used instead of analyzing person-work task fit for individual patients and this study did not include neurocognitive functions which are known to be highly influential in determining occupational functioning. These factors clearly limit the ability to generalize the findings beyond schizophrenia as a group – a group that is heterogeneous in a variety of characteristics that could conceivably be relevant in determining person-job fit. Future research is needed to replicate the findings reported here and to explore how client characteristics (e.g., cognitive functioning) and differences in treatment (i.e., type of antipsychotic medication) impact the performance on these work tasks.

Acknowledgement

This study was funded by Eli Lilly and Company. The authors would like to thank Perla Placencia, Beatriz Sandoval, Richard Franco, and Alexis Mintz for their help with data collection and the staff and clients of the San Fernando Mental Health Center for their support and participation.

References

Becker, D.R., & Drake, R.E. (2003). *A working life for people with severe mental illness*. Oxford: Oxford University Press.

Bond, G.R., Resnick, S.G., Drake, R.E., Xie, H., McHugo, G.J., & Bebout, R.R. (2001). Does competitive employment improve nonvocational outcomes for people with severe mental ill-

ness? *Journal of Consulting and Clinical Psychology*, *69*, 489-501.

Clare, L., McKenna, P.J., Mortimer, A.M., & Baddeley, A.D. (1993). Memory in schizophrenia: What is impaired and what is spared? *Neuropsychologia*, *31*, 1225-1231.

Cook, J.A., Leff, H.S., Blyler, C.R., Gold, P.B., Goldberg, R.W., Mueser, K.T., et al. (2005). Results of a multisite randomized trial of supported employment interventions for individuals with severe mental illness. *Archives of General Psychiatry*, *62*, 505-512.

Cook, J.A., & Razzano, L. (2000). Vocational rehabilitation for persons with schizophrenia: Recent research and implications for practice. *Schizophrenia Bulletin*, *26*, 87-103.

Danion, J.M., Meulemans, T., Kauffmann-Muller, F., & Vermaath, E. (2001). Intact implicit learning in schizophrenia. *American Journal of Psychiatry*, *158*, 944-948.

First, M., Spitzer, R., Gibbon, M., & Williams, J. (1996). *Structured clinical interview for DSM-IV patient edition* (SCID-I/P, Version 2.0). Washington, DC: American Psychiatric Press Inc.

Gold, J.M., Goldberg, R.W., McNary, S.W., Dixon, L.B., & Lehman, A.F. (2002). Cognitive correlates of job tenure among patients with severe mental illness. *American Journal of Psychiatry*, *159*, 1395-1402.

Green, M.F., Kern, R.S., Braff, D.L., & Mintz, J. (2000). Neurocognitive deficits and functional outcome in schizophrenia: Are we measuring the "right stuff?" *Schizophrenia Bulletin*, *26*, 119-136.

Guy, W. (Ed.). (1976). *ECDEU assessment manual for psychopharmacology* (ADM Publication No. 76-338, pp. 218-222). Washington, DC: US Department of Health, Education and Welfare.

Heinrichs, R.W., & Zakzanis, K.K. (1998). Neurocognitive deficit in schizophrenia: A quantitative review of the evidence. *Neuropsychology*, *12*, 426-445.

Kern, R.S., Liberman, R.P., Kopelowicz, A., Mintz, J., & Green, M.F. (2002). Applications of errorless learning or improving work performance in persons with schizophrenia. *American Journal of Psychiatry*, *159*, 1921-1926.

Kirkpatrick, B., Buchanan, R.W., McKenney, P.D., Alphs, L.D., & Carpenter, W.T. (1989). The schedule for the deficit syndrome: An instrument for research in schizophrenia. *Psychiatry Research*, *30*, 119-124.

Lehman, A.F., Goldberg, R., Dixon, L.B., McNary, S., Postrado, L., Hackman, A., et al. (2002). Improving employment outcomes for persons with severe mental illnesses. *Archives of General Psychiatry*, *59*, 165-172.

Liberman, R.P., & Kopelowicz, A. (2005). Recovery from schizophrenia: A concept in search of research. *Psychiatric Services*, *56*, 735-742.

Liberman, R.P., Wallace, C.J., Blackwell, G., Kopelowicz, A., Vaccaro, J.V., & Mintz, J. (1998). Skills training vs. psychosocial occupational therapy for persons with persistent schizophrenia. *American Journal of Psychiatry*, *155*, 1087-1091.

McGurk, S.R., & Mueser, K.T. (2003). Cognitive functioning and employment in severe mental illness. *Journal of Nervous and Mental Disease*, *191*, 175-184.

McHugo, G.J., Drake, R.E., & Becker, D. (1998). The durability of supported employment effects. *Psychiatric Rehabilitation Journal*, *22*, 55-61.

Mueser, K.T., Salyers, M.P., & Mueser, P.R. (2001). A prospective analysis of work in schizophrenia. *Schizophrenia Bulletin*, *27*, 281-296.

SAS/STAT Software Version 9. (2004). Cary, North Carolina: SAS Institute.

Tauber, R., Wallace, C.J., & Lecomte, T. (2000). Enlisting indigenous community supporters in skills training programs for persons with severe mental illness. *Psychiatric Services*, *51*, 1428-1432.

Ventura, J., Green, M.F., Shaner, A., & Liberman, R.P. (1993). Training and quality assurance in the use of the Expanded Brief Psychiatric Rating Scale: The "drift busters." *International Journal of Methods in Psychiatry Research*, *3*, 221-244.

Zarate, R., Liberman, R.P., Mintz, J., & Massel, H.K. (1998). Validation of a work capacity evaluation in individuals with psychiatric disorders. *Journal of Rehabilitation*, *64*, 28-34.