Cognitive Strategies Versus Self-Management Skills as Adjunct to Vocational Rehabilitation

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Cognitive dysfunctions and negative symptoms are “rate-limiting factors” for community outcome and response to psychosocial intervention in people with schizophrenia. Therefore, two cognitive-behavioral group therapies were developed—computer-assisted cognitive strategy training (CAST) and training of self-management skills for negative symptoms (TSSN)—to target these barriers to rehabilitation readiness. One hundred thirty-eight DSM–IV schizophrenia inpatients on a rehabilitation ward were randomly assigned to CAST plus vocational rehabilitation, TSSN plus vocational rehabilitation, or vocational rehabilitation alone. CAST included computer-based training in coping strategies focusing on deficits in attention, verbal memory, and planning. TSSN focused on social withdrawal/social anhedonia, lack of drive/volition, and affect flattening using techniques such as time scheduling, mastery, and pleasure techniques. Treatment outcome was assessed at intake and at discharge after 8 weeks. Analyses of covariance controlling for basis-level functioning demonstrated that patients receiving CAST plus vocational rehabilitation showed greater improvement on attention and verbal memory but not on planning ability. Patients receiving TSSN plus vocational rehabilitation failed to demonstrate improvement in negative symptoms. CAST plus vocational rehabilitation was found to be associated with a higher rate of successful job placement at the 12-month followup interval. Hierarchical logistic regression analyses demonstrated that improvement in short- and long-term verbal memory predicted a higher proportion of variance of successful job placement in the followup than pre-treatment history of employment alone. Cognitive training as an adjunct to inpatient vocational rehabilitation demonstrated cognitive improvement, which was found to be associated with successful job placement in the followup. TSSN’s efficacy was less clear; reasons for this uncertainty are provided.

Keywords: Cognitive therapy/group therapy/vocational rehabilitation/errorless learning/schizophrenia/treatment outcome/cognitive dysfunctions/negative symptoms

Recent reviews (Green 1996; Green and Nuechterlein 1999; Green et al. 2000) have outlined the role of cognitive impairment and persistent negative symptoms in schizophrenia as rate-limiting factors of psychosocial outcome and response to psychosocial intervention. Focusing on these rate-limiting factors as therapeutic targets (e.g., cognitive remediation, training of self-management skills for negative symptoms) may improve psychosocial outcome and expand rehabilitation readiness for people with schizophrenia (Wiedl 1999; Green et al. 2000). The goal of the present study is to investigate outcomes for patients randomly assigned to one of three treatment conditions: (1) cognitive remediation plus vocational rehabilitation, (2) a treatment to improve negative symptoms and motivation plus vocational rehabilitation, and (3) vocational rehabilitation alone.

The perceived impact of cognitive impairment and negative symptoms on day-to-day functioning has led to the development of cognitive rehabilitation techniques (Krab bendam and Aleman 2003) and symptom management strategies to remedy these impairments and thus enhance response to psychosocial interventions. Nonresponsiveness to rehabilitation needs to be approached as a multidimensional syndrome through specification of which symptoms in the spectrum of positive symptoms, negative symptoms, and cognitive symptoms lead to failure to respond (Lindenmayer 2000).

Researchers have consistently found that people with schizophrenia score more poorly than others on a wide array of cognitive tasks (Heaton et al. 1994; Bilder et al. 1995; Palmer et al. 1997; Velligan and Miller 1999) and that these deficits persist even when the illness is in remission (Gold and Harvey 1993; Sharma and Harvey 2000). Even if atypical antipsychotic drugs as a group are superior to typical neuroleptics with regard to cognitive function (Keefe et al. 1999; Meltzer and McGurk 1999), many of these impairments are not entirely normalized by the newer atypical neuroleptics (Goldberg et al. 1993; Weinberger et al. 1994; Meltzer and McGurk 1999). Cognitive remediation focuses on the improvement of these cognitive impairments by repetitive laboratory-based exercises directly related to the cognitive process being trained and the building of compensatory cognitive strategies (Spring and Ravdin 1992; Ben-Yishay and Diller 1993). Although studies have shown increases...
in discrete cognitive functions, there are too few studies that include more real-world outcomes and longitudinal evaluation techniques (Krabbendam and Aleman 2003). Only recently have researchers begun to focus on cognitive remediation to vocational rehabilitation as an adjunct to psychosocial intervention (Bell et al. 2001) and focus on cognitive remediation to improve response to therapy, for instance, social skills training (Spaulding et al. 1999). In the study of Bell et al. (2001), patients were randomly allocated to one of two conditions: work therapy 15 to 20 hours a week and work therapy combined with “neurocognitive enhancement therapy,” 2 to 3 sessions per week up to 5 hours for 26 weeks. Cognitive exercises focusing on repeated practice of attention, memory, and executive functioning were computer assisted. Patients receiving both neurocognitive enhancement therapy and work therapy showed greater improvements on pretest-posttest variables of executive functioning, working memory, and affect recognition.

Despite the significance of these findings, three major points are still open to question. First, there is a general lack of randomized controlled trials that examine cognitive remediation with sufficient sample size (Hayes and McGrath 2000), and those that do exist sometimes have contradictory results (e.g., Suslow et al. 2001). Second, the definition of cognitive remediation is relatively broad, and underlying mechanisms of cognitive change are poorly understood. Most of the studies showed only that participants were able to learn very specific skills, which would not demonstrate that underlying cognitive processes required for the tasks have improved, or that the skills being measured generalize to other tasks that require the same basic-level cognitive processes. Third, we have only limited information concerning whether improved skills generalize to more clinically relevant tasks, such as community functioning, symptomatology, or treatment response.

Persistent negative symptoms in schizophrenia are predictive of social and vocational disability (Breier et al. 1991; Bailer et al. 1996) and therapy response (e.g., to social skills training [Hoffman et al. 1997; Kopelowicz et al. 1997] and cognitive rehabilitation programs [Stratta et al. 1997]). Two basic therapeutic principles are employed in intervention programs focusing on negative symptoms: incentive therapies and building of compensatory skills (Fenton 2000). Approaches that focus more directly on negative symptoms are targeted on emotional information processing. McGlashan et al. (1990) trained patients to focus on vegetative components of emotions, labeling of emotions, and enhancement of tolerance for more intense levels of emotions. Vauth et al. developed a “training of emotional intelligence” approach focusing on emotional management and perception of emotions in patients and others (1997, 2001b). Also, they developed training of self-management skills for negative symptoms (TSSN; Vauth et al. 1999), which is reported in the present study.

In our study, we evaluated the effects of computer-assisted cognitive strategy training (CAST) (Vauth et al. 2000) and TSSN (Vauth et al. 1999) as adjuncts to vocational rehabilitation. Patients were randomly assigned to receive vocational rehabilitation alone or one of the two training programs plus vocational rehabilitation. To our knowledge, the present study is the second (Bell et al. 2001) to combine methods of cognitive training with vocational rehabilitation and the first to compare the effects of cognitive training and negative symptom management on vocational integration.

The first hypothesis of this study was that in the context of vocational therapy, cognitive training would enhance recovery of cognitive deficits in the therapeutically targeted functional domains of attention, verbal memory, and planning; TSSN would reduce negative symptoms and related measures. A second hypothesis was that the cognitive-behavioral intervention would improve the rate of competitive employment in the 12-month follow-up beyond the improvement provided by vocational rehabilitation alone.

Methods

Subjects. One hundred and thirty-eight inpatients with a DSM–IV diagnosis of schizophrenia admitted consecutively to a rehabilitation ward of the Department of Psychiatry and Center for Rehabilitation/Klinikum Karlsbad-Langensteinbach, Abteilung für Klinische und Sozialpsychiatrie, Karlsbad, Germany, were included in the study. Patients were stratified for neuroleptic treatment (atypical vs. typical) and then randomized to treatment: CAST plus vocational rehabilitation (CAST), TSSN plus vocational rehabilitation (TSSN), or vocational rehabilitation alone (VRA). All provided informed written consent. The diagnosis of schizophrenia was confirmed by the Structured Clinical Interview for DSM–IV Axis I Disorders (First et al. 1996; Wittchen et al. 1997; Gibbons et al. 1998), which was completed by trained and reliable interviewers (kappa = 0.84). Patients were not considered stable enough to participate if there had been a change in psychiatric medication or if they had had an episode of alcohol or drug abuse in the last 30 days. Chart diagnoses of neurological disease and/or serious medical illness were also causes for exclusion. Patients were assessed in the first week of a vocational training program for schizophrenia inpatients. About 64.5 percent of the subjects were male, and the mean age was 28.8 years (standard deviation [SD] = 7.1); 52.9 percent of the patients had had no meaningful work in the preceding year. Mean number of lifetime hospitalizations was 3.0 (SD = 3.4), with a rate of 1.6 (SD = 1.4) rehospitalizations in the last 2 years. The mean age of illness onset was 22.8 years (SD = 5.6), and the mean duration of illness was 6.6 years (SD = 5.5). All patients were receiving antipsychotic medication prior
to and throughout the study; 75.2 percent of patients were receiving an atypical neuroleptic drug only, and 24.8 percent were receiving a typical neuroleptic medication. The number of patients with either part-time or full-time competitive work in the year before admission was CAST 21 (45.7%), TSSN 23 (51.1%), and VRA 21 (45.7%). For history of past lifetime employment, we found part- or full-time employment for CAST 34 (72.3%), TSSN 36 (80%), and VRA 38 (82.6%). Post hoc chi-square tests of group differences in part- or full-time employment rates (last 12 months and lifetime) showed no significant differences ($p > 0.10$) across treatment groups.

**Treatment-Specific Outcome Measures.** Measures were included in the study that assessed three domains related to the essential questions of this study: negative symptoms, cognitive outcome, and work.

**Negative symptoms.** Negative symptoms were assessed using the Positive and Negative Syndrome Scale (PANSS; Kay et al. 1986, 1987). PANSS interviewers had been trained previously to a minimum intraclass correlation (ICC; Shrout and Fleiss 1979) of 0.80 based on consensus ratings at our research unit. Studies on factors underlying schizophrenia symptoms assessed by the PANSS indicate that a four-syndrome model containing disorganization and disorder of relating dimensions as well as negative and positive dimensions better fits the data (Cuesta and Peralta 1995) than the model of Kay et al. (1986, 1987). Additionally, better predictive validity for the four-syndrome model has been demonstrated (Hoffman and Kupper 1997; Suslow et al. 2000). As a treatment-specific outcome measure of the TSSN, we selected the negative dimension of the four-factor solution. To control for potential confounding effects, we also used the positive dimension and depression as covariates. Depression was assessed by the Calgary Depression Scale (CDSS; Addington et al. 1990), which was developed to assess symptoms of major depressive disorder in schizophrenia and consists of nine items: depressed mood, hopelessness, self-deprecation, guilty ideas of reference, pathological guilt, depression that is worse in the morning, early wakening, suicidal ideation, and observed depression. The items on the CDSS do not appear to overlap with the negative symptoms of schizophrenia. Items are scored on a four-point scale of severity (3 = severe). Interrater reliability of the nine CDSS items was sufficient, with ICCs (Shrout and Fleiss 1979) ranging from 0.68 (pathological guilt) to 0.76 (early weakening).

To approximate the subjective experiencing of negative symptoms, the degree to which a person is able to experience pleasure or the anticipation of a pleasurable experience was used as treatment-specific outcome variable. This was addressed by the German version (SHAPS–D; Franz et al. 1998) of the Snaith-Hamilton Pleasure Scale (SHAPS; Snaith et al. 1995). The SHAPS–D comprises 14 items covering four self-reported domains of pleasure responses and estimates the degree to which a person is able to experience pleasure or the anticipation of a pleasurable experience. This was also regarded as an important precondition in achievement motivation and as a consequence in vocational rehabilitation. For data analysis, the summary score is used. The reliability and validity of the SHAPS–D have been well established for people with schizophrenia (Snaith et al. 1995; Franz et al. 1998).

**Cognitive outcome.** Measures of cognitive functioning were selected based on the aims of the cognitive strategy training. **Selective attention** was measured by a letter cancellation test (‘‘Aufmerksamkeits-Belastungstest’’; Brickenkamp 1981). This test requires visual selectivity at fast speed on a repetitive motor response task. The task demands the identification of ‘‘d’’ with two lines either on top or below the character as target and inhibition of response if nontarget characters appear (‘‘d’’ without two lines, or ‘‘p,’’ ‘‘q,’’ or ‘‘b’’). The performance is scored for number of targets crossed out within the allotted time minus false alarms to control for the response bias by the perceived payoffs for correct identifications and perceived penalties for incorrect identifications (Davies and Paranuraman 1982). This measure has been shown to be sensitive to change that results from cognitive remediation in schizophrenia (for a review, see Suslow et al. 2001).

**Verbal memory** was assessed by the German validated version (Heubrock 1992) of the Rey Auditory Verbal Learning Test (Rey 1964). It consists of five presentations with free recall of a 15-word list at a rate of one word per second. **Immediate recall** is measured by the number of correctly recalled words at the first presentation. The number of correctly recalled words after 30 minutes assessed is a measure of **delayed recall**. Other parameters were not selected to prevent inflation of alpha error by multiple testing.

**Planning abilities** were measured by the Tower of Hanoi Test (Glosser and Goodglass 1990). In this test, the subject must look ahead to determine the order of moves necessary to rearrange three colored rings of varying sizes from their initial position on two of three upright sticks to a new set of predetermined positions on one of the sticks. The stipulation is added that when two or more rings are on the same stick the smaller rings must always be on top of the larger ones. Performance was assessed by the number of moves required for solution divided by the solution time to control for confounding effects.

To control for potential confounders of cognitive changes, we assessed age, gender, and years of education. **Verbal intelligence** was assessed using the Mehrfachwahl-Wortschatz-Intelligenztest (MWT–B; Lehrl 1995), a vocabulary-based multiple-choice intelligence test that is a well-established measure of crystallized intelligence in
German-speaking countries. It estimates the premorbid level of verbal intelligence, found to be highly interrelated with the verbal IQ of the Hamburg Wechsler Intelligence Test. Subjects are asked to detect one real word that is presented with four nonsense words, with the real word becoming more difficult during the test. For data analyses we used the raw score, because there are no updated or schizophrenia-specific norms so far.

**Work.** To assess changes in vocational functioning, rate of successful job placement (part- and full-time employment more than 3 months vs. no useful work) in the followup interval was determined.

**Procedures.** After giving informed consent, subjects were rated in psychopathology and then completed treatment-specific self-rating measures and neuropsychological assessment. This occurred during two or three sessions in the first 2 weeks after admission, prior to the beginning of the respective adjuncts to vocational rehabilitation or VRA. Baseline assessment of outcome was done after intake on the rehabilitation ward when patients were stable in psychopathology and medication. Medication was considered stable when there was no change in type of neuroleptic medication or change in dosage exceeding 20 percent during the preceding 2 weeks. Posttest assessment was completed 8 weeks after the interventions began. Patients were discharged after the period of 8 weeks of inpatient vocational rehabilitation and were outpatients during the followup period. Vocational status was assessed 12 months after posttest. All raters were blind to treatment condition.

**Vocational rehabilitation** consisted of graduated job placement in different training sites for up to 15 hours per week with increasing demands, detailed weekly work performance feedback and goal setting, a job coach for job-related difficulties, and individual vocational counseling. More than 15 different work sites included areas such as wood processing, metal processing, commercial practice, and electronic engineering. Only 15 to 20 facilities in Germany provide assessment of vocational functioning and job coaching in so many different domains of professional education. These facilities have a catchment area of about 4 to 6 million people, and so mean time to referral after discharge from an acute ward in state hospitals is 9 to 12 months. Because the state hospitals and the patient homes were often far apart (150–200 miles), the patients lived for 8 weeks as inpatients on a rehabilitation ward. Job coaches were full-time job specialists as opposed to clinical staff members; the former group was found to be associated with a higher rate of successful job placement (Becker et al. 2001).

CAST and TSSN were recently developed by our Research Group for Cognitive-Behavioral Therapy for Schizophrenia (Vauth et al. 1999, 2000, 2001a). In the present study, both group therapies were provided twice weekly for 90 minutes in groups with six to eight schizophrenia inpatients for 8 weeks. Didactic strategies in both group interventions employed errorless learning. This is based on the assumption that the preserved implicit memory in people with schizophrenia results in implicitly remembered incorrect responses interfering with target strategies. A recent study has demonstrated that errorless learning is a technique that can compensate for neurocognitive deficits as they relate to the acquisition of new skills and abilities in the work rehabilitation of persons with schizophrenia (Kern et al. 2003). To improve generalization to job environment, we used the “coping cards” recommended by van der Gaag et al. (1994). Coping cards are usually 3” x 5” notecards that the patient keeps nearby (often in a pocket). The patient is encouraged to read them both on a regular basis (e.g., three times a day) and as needed. These cards include behavioral strategies to use in a specific problematic situation and self-instructions. In this strategy, standard job situations (e.g., instructions given by the job coach) suited for the practice of learned coping strategies were written down first. Then the benefits of coping improvement for the patient were specified (e.g., to minimize mistakes in consecutive realizations of instructions). Lastly, the steps of strategy application were specified.

Based on the results of rate-limiting cognitive dysfunctions (Green 1996; Green et al. 2000; Green and Nuechterlein 1999), CAST focused on deficits in sustained and selective attention, verbal memory, and planning. CAST comprises three steps based on Anderson’s Adaptive Control of Thought Model (ACT; Anderson 1983). First, components of strategies are discussed (declarative stage). Next, there is repeated practice of these strategies on prototypical situations (i.e., repeating instructions of a job coach by verbalizing; proceduralization stage). Finally, training of its generalization to new situations occurs (tuning stage). Additionally, components of cognitive adaptation training (Velligan et al. 1996) were used to train participants to alter their job environment to compensate for cognitive deficits and improve adaptive functioning. A wide range of environmental manipulations were taught to the patients, such as labels, signs, schedules, and rearrangement of objects.

To improve sustained and selective attention, for example, self-instructions were employed, such as “What is the first step?” “What next?” “Don’t get distracted!” and “Way to go!” To improve verbal memory, techniques such as maintenance rehearsal, elaborative rehearsal, and note taking were used. In the second 45-minute portion of each session, learned strategies were reinforced using a computer-presented cognitive training program (Geibel-Jakobs and Olbrich 1998) that focused on corresponding cognitive functions. An illustrative example is a matching task where two stimuli are simultaneously presented on the computer screen. The subject must apply trained self-instructions, scanning the stimuli...
for possible differences. Then the subject responds by pressing one of two buttons (+ = identical, - = different). Whenever the subject presses the incorrect button, auditory feedback is provided.

In TSSN, disturbance of volition, social withdrawal/social anhedonia, and inactivity are gradually replaced with leisure activities by techniques like time scheduling and mastery and pleasure activities. Job cards (van der Gaag et al. 1994) and group homework assignments like taking photos of possible leisure activities are used to achieve further generalization of skills in daily activities of the patients. Motivational techniques like individual cost-benefit ratios are used to enhance motivation and commitment. Within training on nonverbal and verbal communication skills, impoverished speech and affective rigidity/deficits in affect expression are addressed. Through training in emotional management skills like “five sense exercises,” awareness/self-perception of different emotional states is supported.

**Data Analysis.** Analysis proceeded in several stages. First, univariate analyses of variance were used to evaluate differences for the continuous baseline data, and chi-square tests for the dichotomous data of completers and noncompleters collapsed across the three treatment groups. Next, one-way univariate analysis of covariance (ANCOVA) was used to evaluate differences between the three treatment conditions on posttreatment scores of cognitive variables and the negative syndrome variables with baseline scores as covariates. The adjustment was needed to address the association between baseline level and magnitude of change in outcome, because patients with low scores at intake into the study had less room for improvement than those with high pretreatment scores and therefore changed less. We also included confounding factors as covariates in ANCOVA of posttreatment scores. We controlled cognitive outcome for effects of age, sex, years of education, and verbal intelligence, and negative syndrome variables for years of education, verbal intelligence (because of baseline differences), influence of depression, and positive symptoms. When the presence of significant group differences was observed, post hoc preplanned comparisons according to our hypotheses (partly to control for unspecific treatment effects of either intervention) were carried out (for cognitive measures CAST > VRA, but not TSSN > VRA, and for negative syndrome measures TSSN > VRA, but not CAST > VRA). Effect size was calculated by differences of mean scores divided by pooled SD of pairwise compared posttreatment scores.

Finally, multiple logistic regression analyses were carried out to demonstrate that there was a relationship between improvement in pre-post testing on cognitive and negative syndrome variables and improvement of employment outcome 12 months after discharge. We used the standardized residual scores of therapeutic target variables with significant pre-post improvement in logistic regression analyses as independent variables to control for baseline level of functioning (Chapman and Chapman 1989). To control for potentially confounding variables, we included in the multivariate regression analyses age, gender, years of education, verbal intelligence, neuroleptic treatment (typical vs. atypical neuroleptics as a dummy variable), and pretreatment work history (employment status in the 12 months before enrollment). “Useful work” more than 3 months in the 12-month followup after discharge (yes vs. no) was selected as dependent outcome variable. To facilitate interpretation of logit estimates, we report the odds ratios (ORs) and 95 percent confidence intervals (CIs) associated with each independent variable. For dichotomous regressors, the OR approximates the probability that the patient had useful work for more than 3 months during the 12-month followup after discharge from the inpatient vocational rehabilitation unit when the regressor was set equal to 1, divided by the probability when the regressor was set equal to 0. For continuous regressors, we calculated the ORs as an approximation of the probability of useful work, when the regressor was set equal to the mean plus the SD, divided by the probability when it was set equal to the mean only.

**Results**

Means and SDs of psychopathology, medication, and cognitive variables at baseline are shown in table 1. No significant differences were found between all three treatment conditions at baseline for illness-related variables, psychopathology, or cognitive deficits- or negative symptom-related outcome variables. One hundred thirty-eight subjects were recruited, and 38 (27.5%) left the study before completion: 10 patients (21.2%) in CAST plus vocational rehabilitation, 10 patients (22.2%) in TSSN plus vocational rehabilitation, and 18 (39.1%) in VRA. Dropout rates did not differ significantly across conditions ($\chi^2 = 1.9; df = 2; p < 0.38$), but there was a trend toward statistical significance that likelihood of dropout in VRA was higher than in the other two interventions taken together [$\chi^2 (df = 2, n = 138) = 2.60, p < 0.10$]. There were no significant differences in type of neuroleptic treatment between the treatment conditions for first generation antipsychotics (FGAs: $\chi^2 = 0.074; df = 2, p < 0.96$) or for clozapine ($\chi^2 = 0.14; df = 2, p < 0.93$), olanzapine ($\chi^2 = 0.12; df = 2, p < 0.95$), or risperidone ($\chi^2 = 0.035; df = 2, p < 0.98$). Mean dosage of the respective type of neuroleptic treatment was for FGA 85.2 mg chlorpromazine equivalent/day (SD = 187.8), clozapine 203.1 mg/day (SD = 353.8 mg/day), olanzapine 5.1 mg/day (SD = 8.8 mg/day), and risperidone 2.5 mg/day (SD = 2.1 mg/day).

Posttreatment scores for cognitive outcome variables are summarized in table 2; the table also includes
### Table I. Sample characteristics: Sociodemographics, illness-related variables, psychopathology, and vocational functioning at baseline

<table>
<thead>
<tr>
<th>Variable (measure)</th>
<th>CAST + vocational rehabilitation, mean (SD) (n = 47)</th>
<th>TSSN + vocational rehabilitation, mean (SD) (n = 45)</th>
<th>VRA, mean (SD) (n = 46)</th>
<th>One-way ANCOVA/χ² df = 2</th>
<th>Completer, mean (SD) (n = 100)</th>
<th>Dropout, mean (SD) (n = 38)</th>
<th>One-way ANOVA/χ² df = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sociodemographic and illness-related variables</strong></td>
<td></td>
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<tr>
<td>Age, yrs †</td>
<td>28.5 (6.6)</td>
<td>28.5 (6.5)</td>
<td>29.4 (8.1)</td>
<td>0.21 0.81</td>
<td>29.02 (6.2)</td>
<td>28.3 (9.1)</td>
<td>0.29 0.59</td>
</tr>
<tr>
<td>Gender (male, %)</td>
<td>29 (61.7)</td>
<td>32 (71.1)</td>
<td>28 (60.9)</td>
<td>1.30 0.53</td>
<td>69 (69%)</td>
<td>20 (52.6%)</td>
<td>0.07 0.08</td>
</tr>
<tr>
<td>Yrs of education †</td>
<td>12.7 (2.3)</td>
<td>12.8 (3.7)</td>
<td>12.3 (3.1)</td>
<td>0.34 0.71</td>
<td>12.9 (2.9)</td>
<td>11.7 (3.2)</td>
<td>4.3 0.04</td>
</tr>
<tr>
<td>Verbal intelligence (MWT–B, raw score) †</td>
<td>27.7 (5.2)</td>
<td>29.5 (4.8)</td>
<td>27.6 (5.4)</td>
<td>2.00 0.14</td>
<td>29.1 (4.7)</td>
<td>26.1 (4.7)</td>
<td>9.9 0.002</td>
</tr>
<tr>
<td>Age at illness onset</td>
<td>22.7 (5.3)</td>
<td>23.4 (6.1)</td>
<td>22.4 (5.2)</td>
<td>0.36 0.70</td>
<td>23.1 (4.9)</td>
<td>21.9 (7.0)</td>
<td>1.3 0.26</td>
</tr>
<tr>
<td>Duration of illness, yrs</td>
<td>5.8 (4.7)</td>
<td>5.3 (3.7)</td>
<td>7.1 (7.5)</td>
<td>1.20 0.30</td>
<td>5.9 (5.4)</td>
<td>6.5 (5.8)</td>
<td>0.34 0.56</td>
</tr>
<tr>
<td>No. of past admissions</td>
<td>2.9 (2.0)</td>
<td>2.6 (2.1)</td>
<td>3.5 (3.1)</td>
<td>0.80 0.45</td>
<td>2.9 (3.7)</td>
<td>3.2 (2.4)</td>
<td>0.17 0.68</td>
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<tr>
<td><strong>Psychopathology</strong></td>
<td></td>
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<tr>
<td>Positive symptoms (PANSS positive dimension) †</td>
<td>2.9 (1.8)</td>
<td>3.1 (1.5)</td>
<td>2.9 (2.0)</td>
<td>0.06 0.94</td>
<td>2.9 (1.6)</td>
<td>3.3 (2.2)</td>
<td>1.2 0.28</td>
</tr>
<tr>
<td>Negative symptoms (PANSS negative dimension) †</td>
<td>8.7 (3.3)</td>
<td>10.4 (3.9)</td>
<td>10.3 (4.9)</td>
<td>2.40 0.09</td>
<td>9.7 (4.0)</td>
<td>10.1 (4.4)</td>
<td>0.31 0.58</td>
</tr>
<tr>
<td>Cognitive disorganization (PANSS, dimension of disorganization) †</td>
<td>4.8 (1.88)</td>
<td>4.9 (2.1)</td>
<td>5.0 (2.0)</td>
<td>0.08 0.92</td>
<td>4.9 (2.1)</td>
<td>4.8 (1.7)</td>
<td>0.06 0.80</td>
</tr>
<tr>
<td>Social withdrawal (PANSS, disorder of relating) †</td>
<td>6.1 (2.7)</td>
<td>6.5 (2.8)</td>
<td>6.6 (3.3)</td>
<td>0.47 0.62</td>
<td>6.3 (3.0)</td>
<td>6.8 (2.8)</td>
<td>0.94 0.33</td>
</tr>
<tr>
<td>Depression (CDSS)</td>
<td>4.17 (3.1)</td>
<td>4.09 (3.4)</td>
<td>4.5 (3.5)</td>
<td>0.19 0.82</td>
<td>4.0 (3.0)</td>
<td>4.9 (4.0)</td>
<td>2.2 0.14</td>
</tr>
<tr>
<td>Anticipatory anhedonia (SHAPS)</td>
<td>1.9 (2.4)</td>
<td>2.0 (2.3)</td>
<td>2.4 (2.8)</td>
<td>0.44 0.65</td>
<td>1.9 (2.4)</td>
<td>2.5 (2.7)</td>
<td>1.3 0.26</td>
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<tr>
<td><strong>Vocational functioning</strong></td>
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<tr>
<td>Part- or full-time competitive work in the 12 mos before admission (n, %)</td>
<td>21 (44.7)</td>
<td>23 (51.1)</td>
<td>21 (45.7)</td>
<td>0.44 0.80</td>
<td>52 (52.0)</td>
<td>21 (55.3)</td>
<td>0.12 0.85</td>
</tr>
<tr>
<td>Part- or fulltime competitive work—lifetime (n, %)</td>
<td>34 (72.3)</td>
<td>36 (80.0)</td>
<td>38 (82.6)</td>
<td>1.50 0.46</td>
<td>80 (80.0)</td>
<td>10 (26.3)</td>
<td>0.65 0.42</td>
</tr>
<tr>
<td>Attention (letter cancellation test)</td>
<td>364.0 (96.5)</td>
<td>394.0 (120.7)</td>
<td>346.1 (113.5)</td>
<td>2.10 0.13</td>
<td>375.1 (112.5)</td>
<td>347.8 (106.5)</td>
<td>1.6 0.21</td>
</tr>
<tr>
<td>Immediate recall (RAVLT, A1)</td>
<td>6.1 (1.5)</td>
<td>6.1 (1.6)</td>
<td>6.1 (1.7)</td>
<td>0.02 0.98</td>
<td>6.2 (1.6)</td>
<td>6.0 (1.6)</td>
<td>0.14 0.71</td>
</tr>
<tr>
<td>Delayed recall (RAVLT, A7)</td>
<td>9.7 (3.1)</td>
<td>10.3 (3.6)</td>
<td>9.1 (3.7)</td>
<td>1.30 0.27</td>
<td>10.0 (3.4)</td>
<td>8.9 (3.6)</td>
<td>2.8 0.10</td>
</tr>
<tr>
<td>Planning (Tower of Hanoi, no. of trials) †</td>
<td>28.5 (15.0)</td>
<td>32.7 (16.9)</td>
<td>29.7 (12.9)</td>
<td>0.84 0.43</td>
<td>29.5 (14.5)</td>
<td>31.7 (15.0)</td>
<td>0.55 0.46</td>
</tr>
</tbody>
</table>

*Note.*—ANCOVA = analysis of covariance; ANOVA = analysis of variance; CAST = computer-assisted cognitive strategy training; CDSS = Calgary Depression Scale; MWT–B = Mehrfachwahl-Wortschatz-Intelligenztest; PANSS = Positive and Negative Syndrome Scale; RAVLT = Rey Auditory Verbal Learning Test; SD = standard deviation; SHAPS = Snaith-Hamilton Pleasure Scale; TSSN = training of self-management skills for negative symptoms; VRA = vocational rehabilitation alone.

†ANOVA.

*Chi-square (2-tailed, df = 1).

†Greater value means stronger disturbance.
ANCOVAs that represent the overall significance of posttreatment score comparisons, and also preplanned comparisons accordingly to our hypotheses after an overall significant group effect was found. CAST appeared superior to VRA in measures of attention (only a trend to statistical significance), and immediate and delayed recall, and TSSN did not, pointing to a specific effect of the cognitive training. Outcome values were adjusted for baseline-level functioning and confounding effects of age, gender, years of education, and verbal intelligence. No significant difference was found for TSSN in improvements of negative symptoms (table 3).

Generalization of treatment success was examined by comparing the rates of successful job placement in the 12-month followup (more than 3 months half- or full-time employment or at least sheltered workshop jobs). An intent-to-treat analysis was employed, which used all patients randomized to a condition regardless of lost-to-followup status. Treatment conditions did not differ at baseline in employment rate in the 12 months before intake, in rate of preceding history of part- or full-time employment, or in rates of loss to followup. The number of patients lost to followup were for CAST 11 (23.4%), TSSN 9 (20.0%), and VRA 13 (28.2%), respectively.

The rate of successful job placement (more than 3 months of half- or full-time employment or at least sheltered workshop jobs) was 24/37 for CAST, 21/35 for TSSN, and 12/28 for VRA. Therefore, the rate of successful job placement was higher for CAST than for VRA ($\chi^2 = 3.2; df = 1; p < 0.04$); neither TSSN and VRA ($\chi^2 = 1.8; df = 1; p < 0.08$) nor CAST and TSSN ($\chi^2 = 0.18; df = 1; p < 0.35$) differed significantly. The OR for CAST versus VRA was 2.3, which means that CAST was 2.3 times as effective as VRA in returning people to work in the year following termination of CAST. Also, 1-tailed chi-square testing of frequencies-differences showed that according to our hypotheses there was a trend to statistical significance in favor of TSSN compared with

<table>
<thead>
<tr>
<th>Variable (measure)</th>
<th>CAST + vocational rehabilitation, mean (SD) ($n = 37$)</th>
<th>TSSN + vocational rehabilitation, mean (SD) ($n = 35$)</th>
<th>VRA, mean (SD) ($n = 28$)</th>
<th>ANCOVA, $^1$ 2-tailed ($F_{2,97}; p$) and preplanned post hoc comparisons ($F; df = 1$; $p$)</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention (letter cancellation test: d2, GZ–F)</td>
<td>369.7 (60.8)</td>
<td>342.7 (58.0)</td>
<td>343.0 (55.2)</td>
<td>2.41 0.09</td>
<td></td>
</tr>
<tr>
<td>Immediate recall (RAVLT, A1)</td>
<td>6.4 (2.1)</td>
<td>5.2 (1.7)</td>
<td>5.3 (2.2)</td>
<td>3.8 0.002</td>
<td></td>
</tr>
<tr>
<td>Delayed recall (RAVLT, A7)</td>
<td>9.9 (3.1)</td>
<td>8.2 (2.8)</td>
<td>8.0 (3.6)</td>
<td>3.6 0.03 0.24</td>
<td></td>
</tr>
<tr>
<td>Planning (Tower of Hanoi, no. of trials)$^+$</td>
<td>28.1 (2.5)</td>
<td>32.3 (1.9)</td>
<td>29.5 (2.2)</td>
<td>1.2 0.30</td>
<td></td>
</tr>
</tbody>
</table>

Note.—ANCOVA = analysis of covariance; CAST = computer-assisted cognitive strategy training; GZ–F = Gesamtzeichen-Fehler = total performance minus number of errors; MWT–B = Mehrfachwahl-Wortschatz-Intelligenztest; RAVLT = Rey Auditory Verbal Learning Test; SD = standard deviation; TSSN = training of self-management skills for negative symptoms; VRA = vocational rehabilitation alone.

$^1$One-way ANCOVA for effects of different treatment conditions on cognitive posttreatment scores with baseline scores, and for confounding effects of age, years of education, and verbal intelligence (MWT–B) as covariates. When the presence of significant group differences on posttreatment scores was observed, pairwise post hoc preplanned comparisons were carried out. Letter cancellation test = Aufmerksamkeits-Belastungstest d2. Effect size was calculated by differences of mean difference divided by pooled SDs of compared posttreatment scores.

$^+$Greater value means stronger disturbance.
Negative dimension + PANSS, subscale of Negative symptoms were carried out. Effect size was calculated by differences of mean differences divided by pooled SD of compared posttreatment scores. When the presence of significant group differences on posttreatment scores was observed, pairwise post hoc preplanned comparisons to control for possible confounding effects of "secondary negative symptoms": level of depression (CDSS), level of positive symptoms (PANSS, positive score), and adjustment for baseline differences in years of education and verbal intelligence (MWT–B) as covariates.

SHAPS = Snaith-Hamilton Pleasure Scale; TSSN = training of self-management skills for negative symptoms; VRA = vocational rehabilitation alone.

One-way ANCOVA for effects of different treatment conditions on negative syndrome posttreatment scores with baseline scores, and to control for possible confounding effects of "secondary negative symptoms": level of depression (CDSS), level of positive symptoms (PANSS, positive score), and adjustment for baseline differences in years of education and verbal intelligence (MWT–B) as covariates. When the presence of significant group differences on posttreatment scores was observed, pairwise post hoc preplanned comparisons were carried out. Effect size was calculated by differences of mean differences divided by pooled SD of compared posttreatment scores.

Greater value means stronger disturbance.

### Table III. ANCOVA for posttreatment scores of negative syndrome measures

<table>
<thead>
<tr>
<th>Variable (measure)</th>
<th>CAST + vocational rehabilitation, mean (SD) (n = 37)</th>
<th>TSSN + vocational rehabilitation, mean (SD) (n = 35)</th>
<th>VRA, mean (SD) (n = 28)</th>
<th>ANCOVA, 1 2-tailed (F2,97; p) and preplanned post hoc comparisons (F; df = 1; p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative symptoms (PANSS, subscale of negative dimension)</td>
<td>8.6 (1.7)</td>
<td>8.2 (1.8)</td>
<td>8.5 (2.1)</td>
<td>0.43</td>
</tr>
<tr>
<td>Anticipatory anhedonia (SHAPS)</td>
<td>1.6 (1.2)</td>
<td>1.1 (.90)</td>
<td>1.3 (1.0)</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Note.—ANCOVA = analysis of covariance; CAST = computer-assisted cognitive strategy training; CDSS = Calgary Depression Scale; MWT–B = Mehrfachwahl-Wortschatz-Intelligenztest; PANSS = Positive and Negative Syndrome Scale; SD = standard deviation; SHAPS = Snaith-Hamilton Pleasure Scale; TSSN = training of self-management skills for negative symptoms; VRA = vocational rehabilitation alone.

1One-way ANCOVA for effects of different treatment conditions on negative syndrome posttreatment scores with baseline scores, and to control for possible confounding effects of "secondary negative symptoms": level of depression (CDSS), level of positive symptoms (PANSS, positive score), and adjustment for baseline differences in years of education and verbal intelligence (MWT–B) as covariates. When the presence of significant group differences on posttreatment scores was observed, pairwise post hoc preplanned comparisons were carried out. Effect size was calculated by differences of mean differences divided by pooled SD of compared posttreatment scores.

### Discussion

In a randomized controlled trial with 138 DSM–IV schizophrenia inpatients on a rehabilitation ward, we focused on rate-limiting factors of community functioning and of response to psychosocial intervention (cognitive dysfunctions and negative symptoms). We compared the improvement of cognitive functioning after CAST as adjunct to vocational rehabilitation with VRA and the improvement of negative symptoms after TSSN as adjunct to vocational rehabilitation with VRA. Also, we compared successful job placement in the 12-month followup.

We found improvements in independent measures and blind ratings of verbal memory and a trend to statistical significance for attention in the CAST as adjunct to vocational rehabilitation superior to VRA. Furthermore, we demonstrated the specificity of CAST, showing that cognitive improvement was found in CAST but not in TSSN. We failed to find significant differences in planning ability. But Wykes et al. (2003b) found mixed results with respect to planning ability too (positive effects on Modified Six Elements, no effects on Tower of London). Maybe our measure of planning (Tower of Hanoi) was not sensitive to changes in everyday planning or the dose of treatment was insufficient for improvement. Generalization of treatment effects on successful job placement in the 12-month followup was demonstrated for only the CAST; the odds ratio for CAST versus VRA was 2.3, which means that CAST was 2.3 times as effective in successful job placement as VRA. Additionally, logistic regression revealed preliminary evidence for a relationship between cognitive
improvement (at least in verbal memory) and employment outcome after 1 year, even if controlled for age, gender, years of education, and verbal intelligence. That we found only predictive power for (short- and long-term) verbal memory is in line with the findings of Wykes et al. (2003a), who demonstrate a higher lastingness of memory improvements 6 months after a cognitive remediation program. In addition, consistent with the fact that we failed to find any association between improvement of attention and employment, Bryson and Bell (2003) demonstrate that attention is more important for initial success in work performance and verbal memory becomes more important for sustained improvement of work performance.

Participation in TSSN failed to show significant differences in objective measures of negative symptoms (PANSS, SHAPS). Perhaps the negative results in objective measures were caused by a floor effect. Patients showed only low to moderate levels of negative symptoms or anticipatory anhedonia at baseline. For the TSSN we found only a trend to statistical significance compared with VRA; the odds ratio found was 1.78, but it should be regarded with caution. Because of floor effects, TSSN’s efficacy in more severely disturbed patients is still an open question. Furthermore, one could assume that the relative ineffectiveness of TSSN in improving posttreatment employment may be attributed to its lack of effectiveness in treating negative symptoms.

The present study has some methodological strengths and shortcomings as well. For the CAST we used theoretical approaches to instructional training developed in the educational field (errorless learning, Anderson’s ACT related to steps of strategy building) to develop our training package. Participants were characterized comprehensively, with a wide range of cognitive, symptomatic, and behavioral measures. The hypotheses of specific

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95% CI</th>
<th>Wald $\chi^2$ (df = 1)</th>
<th>$p$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>1.00</td>
<td>0.96–1.10</td>
<td>0.56</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>Gender (man = 1)</td>
<td>1.20</td>
<td>0.50–2.80</td>
<td>0.14</td>
<td>0.71</td>
<td></td>
</tr>
<tr>
<td>Verbal intelligence (MWT–B)</td>
<td>0.94</td>
<td>0.86–1.00</td>
<td>1.90</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>Yrs of education</td>
<td>1.00</td>
<td>0.88–1.20</td>
<td>0.26</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>Employed in the 12 mos before treatment</td>
<td>4.40</td>
<td>3.50–5.30</td>
<td>12.50</td>
<td>0.000</td>
<td>0.17</td>
</tr>
<tr>
<td>Type of neuroleptic treatment (conventional = 0, atypical = 1)</td>
<td>0.73</td>
<td>0.12–0.55</td>
<td>0.53</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>1.10</td>
<td>1.00–1.20</td>
<td>4.30</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Gender (man = 1)</td>
<td>1.60</td>
<td>0.62–4.30</td>
<td>1.00</td>
<td>0.31</td>
<td></td>
</tr>
<tr>
<td>Verbal intelligence (MWT–B)</td>
<td>0.91</td>
<td>0.82–1.00</td>
<td>2.40</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Yrs of education</td>
<td>0.96</td>
<td>0.79–1.20</td>
<td>0.11</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>Employed in the 12 mos before treatment</td>
<td>4.30</td>
<td>3.40–5.20</td>
<td>9.70</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Type of neuroleptic treatment (conventional = 0, atypical = 1)</td>
<td>0.65</td>
<td>0.27–1.60</td>
<td>0.92</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>Attention (letter cancellation test d2)</td>
<td>01.2</td>
<td>0.49–3.00</td>
<td>0.18</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Short-term memory improvement (RAVLT A1)</td>
<td>3.00</td>
<td>1.50–6.20</td>
<td>8.90</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Long-term memory improvement (RAVLT A7)</td>
<td>2.60</td>
<td>1.20–5.60</td>
<td>5.90</td>
<td>0.015</td>
<td>0.40</td>
</tr>
</tbody>
</table>

Note.—ANCOVA = analysis of covariance; CI = confidence interval; MWT–B = Mehrfachwahl-Wortschatz-Intelligenztest; OR = odds ratio; RAVLT = Rey Auditory Verbal Learning Test; SD = standard deviation; SHAPS = Snaith-Hamilton Pleasure Scale; TSSN = training of self-management skills for negative symptoms; VRA = vocational rehabilitation alone.

1To control the effects of a set of covariates (age, gender, verbal intelligence, years of education, and history of employment in the 12 months before treatment), a sequential logistic regression analysis was conducted, contrasting block 1 with a set of covariates to control for and block 2 (also, to control for baseline-level functioning in improvement, z standardized residual change scores for cognitive variables, for which significant improvement was demonstrated in the ANCOVAs in table 2). The Wald test is a z test using the logistic coefficient for a given independent variable, divided by standard error; $R^2$ = Nagelkerke’s $R^2$ measure seeks to make a statement about the percentage of variance explained for the set of covariates to control for (block 1) and adding the variables residualized change scores of cognitive improvement (block 2).
remediation were linked to specific outcomes; that is, CAST was to improve cognitive functioning, and TSSN was to improve negative symptoms. Potential confounders related to improvement were controlled for too. The study is the second to combine methods of cognitive training with vocational rehabilitation (Bell et al. 2001) and the first to combine symptom management with vocational rehabilitation. Its elements interact within a framework of place-then-train (Corrigan 2001) to maximize the likelihood that adjunctive therapy will generalize to vocational outcomes. Furthermore, there was a trend to statistical significance that likelihood of dropout in VRA was higher than in both adjunctive interventions taken together, suggesting perhaps that overall treatment adherence is facilitated by implementation of cognitive-behavioral group interventions as an adjunct to vocational rehabilitation.

But there are also several shortcomings of the present study. The dropout rate was very high—about 25 percent of the sample; even if statistical analyses of baseline data failed to demonstrate a systematic selection effect, generalization of results should be replicated by further randomized controlled studies. Effect sizes were moderate, so conclusions should be drawn with caution. However, effect sizes were in the upper limit found for most of the reviewed randomized controlled trials of cognitive rehabilitation programs for schizophrenia techniques (Krabbenand and Aleman 2003), which ranged from 0.26 to 0.64 (95% CI; mean 0.45). The results of our study give additional evidence in favor of strategic learning versus rehearsal-oriented approaches to cognitive remediation. The efficacy of TSSN is still an open question because of floor effects in our study. Maybe lack of effectiveness of TSSN in improvement of vocational outcome was also a consequence of these. The interaction between cognitive-behavioral interventions and pharmacological treatments could not be analyzed because a more homogeneous neuroleptic treatment within a double-blind randomized controlled trial for type of neuroleptic treatment would be necessary to control for effects of neuroleptic treatments and clinical decision making. Also, dosage of cognitive-behavioral intervention (e.g., the role of booster sessions) and treatment elements or didactic strategies that are necessary preconditions to efficacy are not yet clear and would require dismantling strategies.

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