

Wiser, better, stronger?
The Effect of Metacognitive Insight on Functional Recovery in
Patients Suffering from Early Psychosis.

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Abstract

It has been argued that functional recovery of patients in the first period of psychosis (Early Psychosis) is a predictor for long-term recovery.⁴ To facilitate functional recovery in work and education, vocational interventions are the main used treatments. Wykes and Reeder (2006) argued that the addition of cognitive remediation therapy facilitates higher functional recovery.³⁷ Metacognitive insight, the awareness of one's own cognitive abilities, is one of the essential elements in this cognitive remediation therapy. To date the relation between metacognitive insight and functional recovery has not yet been investigated. The variable metacognitive insight was composed of the difference between objective cognitive functioning and subjective cognitive functioning. Subjective cognitive functioning is the self-perceived cognitive functioning, based on the complaints that people report on their own cognitive functioning, whereas objective cognitive functioning is based on standardized cognitive tests scores. The current study investigated the relation between objective cognitive functioning and subjective cognitive functioning, assessed the effect of cognitive remediation therapy on metacognitive insight and assessed the influence of metacognitive insight on functional recovery in work and education. Sixty-eight early psychotic patients were recruited from Dutch healthcare intuitions and were treated with a vocational intervention plus cognitive remediation therapy. Patients were tested on a set of neuropsychological tasks, cognitive complaints, and vocational activity at three measurement occasions (at baseline, after 6 months and after 18 months). There was no association between objective and subjective cognitive functioning, there was no effect of cognitive remediation therapy on metacognitive insight, and there was no effect of metacognitive insight on functional recovery. Findings suggest that metacognitive insight does not have impact on functional recovery. The present study is especially relevant because it contributes to the knowledge about the role of metacognitive insight in cognitive remediation therapies in early psychotic patients.

Keywords: Early Psychosis, Cognitive Functioning, Metacognitive insight, Vocational Intervention, Functional Recovery



Introduction

Psychotic illnesses like schizophrenia are a major mental health problem. Psychotic illnesses are labeled as Severe Mental Illnesses (SMI).¹ Studies showed that the life expectancy of people with a Severe Mental Illness is reduced by 15-25 years and that these people are affected in i.e. housing, work, education and personal relationships.^{2, 3}

Previous research suggested that recovery in everyday functioning (“functional recovery”) in the first period of psychosis (Early Psychosis) is a predictor for long-term recovery in terms of prevention of a second episode.⁴ Functional recovery in work and education is facilitated through vocational interventions. These are interventions focused on helping people regain the ability to participate in work or school, rather than to treat the mental illness on itself. To date the most common vocational intervention is Individual Placement and Support (IPS). IPS has the goal to provide the patient support in finding and maintaining a job or study to improve employment prospects in patients with Severe Mental Illnesses and moreover, focusses on the job or education preferences of the patient and efficient contact with the employer or the school. Specifically, IPS is proven to be an effective intervention for people with a psychosis.^{5, 6, 7}

In addition to vocational interventions, focus also shifted to interventions aiming for cognitive recovery (“cognitive remediation”).^{19, 20, 21} Cognitive deficits develop in the early years of psychotic illness: Early psychotic patients express cognitive deficits mainly in executive functioning, sustained attention, working memory and long-term verbal memory.^{8, 9} In line with this statement, research showed that the first signs of cognitive deficits in patients with early onset schizophrenia are seen in regions associated with deficits in attention and episodic memory (parietal lobes). These deficits progress into the regions associated with deficits in long term memory (temporal lobes) and finally into regions associated with deficits in working memory and executive functioning (frontal lobes).^{10, 11, 12} Blakemore (2008) argued that age is a contributing factor in cognitive recovery of early psychotic patients: There could be a greater cognitive improvement and prevention of cognitive decline in younger psychotic patients. Specifically, the ongoing neurodevelopment in this early stage represents a greater brain plasticity.⁸ Indeed, studies have demonstrated that younger psychotic patients respond better to interventions targeting cognitive processes than older patients in terms of improvement of cognitive deficits.^{13, 14, 15}

The appearance of above mentioned cognitive deficits are associated with impaired functioning in society related to work and education. Bell and colleagues (2003) showed that



patients with schizophrenia suffering from major cognitive deficits experience more problems at work and are working less hours than patients with less cognitive problems.¹⁶ Killackey and Allott (2013) illustrated that cognitive difficulties are a barrier for people with a psychosis in maintaining employment.¹⁷ Moreover, whereas psychotic symptoms do influence functional recovery, cognitive deficits appear to be more accurate in predicting functional recovery in early psychotic patients in the long term.¹⁸ Furthermore, the addition of cognitive training was found to be superior in terms of successful job placement of patients participating in vocational interventions, in comparison with patients receiving vocational intervention as a standalone intervention.^{19, 20, 21} Summarized, it is important to enhance cognitive functioning since patients experience less problems at work/school (direct effect); consequently, patients experience the barrier to stay employed to a lesser extent (indirect effect). Hereby, functional recovery is facilitated.

To specify, Chang and colleagues (2015) argued that cognitive functioning can be divided into objective cognitive functioning and subjective cognitive functioning. Objective cognitive functioning is based on standardized cognitive tests battery. Subjective cognitive functioning is the self-perceived cognitive functioning, based on the complaints that people report on their own cognitive functioning.²² However, subjective cognitive functioning is not equal to awareness of one's own cognitive functioning; Patients can have complaints about their cognitive functioning, but this doesn't have to match with their objective cognitive test scores. Subjective cognitive functioning is underestimated in people with psychotic diseases, particularly in the early illness stage. Research of Moritz and colleagues (1999) revealed significant associations of subjective cognitive functioning with symptomatic deterioration and quality of life in patients diagnosed with first- episode schizophrenia.²³ There are opposing views about the relation between subjective cognitive functioning and objective cognitive functioning. A positive relation between objective and subjective cognitive functioning in patients with schizophrenia has been demonstrated by a number of studies.^{24, 25, 26} On the contrary, there is convincingly evidence for a lack of significant association between objective and subjective cognitive functioning in patients with schizophrenia.^{27, 28, 29, 30, 31, 32, 33} It is argued that objective and subjective cognitive functioning are independent constructs. The discrepancy between these two variables is possibly explained by the mediation of a third variable: metacognitive insight.²² Metacognitive insight is the awareness of your cognitive abilities, it provides an answer to the question "how do I function during daily activities?" It is a part of metacognition, 'thinking about thinking'.³⁴ Schraw and Dennisson (1994) argued that metacognition can be divided into knowledge of cognition and regulation of cognition.



Metacognitive knowledge involves knowledge about thinking processes in general and knowledge about your own cognition (e.g. “I have a sharp concentration”), whereas metacognitive regulation involves the planning, acting on and evaluation of your metacognitive skills.³⁵ Metacognitive insight is involved in both processes: knowledge about your own cognition involves the insight about your own cognitive functioning, whereas metacognitive regulation involves awareness of your own available set of cognitive tools to use for this specific action. In the present study, metacognitive insight can be perceived as the association between objective and subjective cognitive functioning (e.g. I have a good memory and I am aware of this). In line with this statement, Lysaker and colleagues (2005) found that understanding of one's own mind was positively associated with neurocognitive functioning.³⁶ Furthermore, Wykes and Reeder (2006) suggested that metacognition serves as a mediator in the relation between cognitive functioning and functional recovery: Metacognition is important in helping someone transfer cognitive skills and knowledge to everyday situations. Facilitating metacognition, in the sense of making the patient aware about their cognition, is the primary target of modern cognitive remediation therapies; therapies that have the aim to improve cognitive function and thinking skills.³⁷ Therefore, in this study, cognitive remediation therapy (CRT) is used as an add-on to the vocational intervention (IPS).

According to Wykes and colleagues (2011), there are two types of learning in CRT: implicit learning, based on repeating a task which becomes gradually more difficult (“drill and practice”) and strategy learning where the focus is on the explicit use of a pre-determined strategy (“drill and strategy”). It is argued that the use of strategies is essential for the transfer to everyday situations because it facilitates awareness of one's own cognition.³⁸ The use of effective strategies involves teaching the client to use strategies which match with the cognitive style of the client.³⁷ Drill and strategy-based interventions are used more often in socio-cognitive remediation and seem to be more effective on psychosocial functioning than drill and practice-based interventions.^{39, 40} The effect on work or education, however, is not clear. To measure effectiveness of vocational interventions such as IPS, vocational activity serves as an important outcome measurement and should be taken into account. In view of this research gap, it is important to specify the effect of cognitive remediation on functional recovery in terms of work and education.

The goal of the current study is to investigate the relation between objective cognitive functioning and subjective cognitive functioning, to assess the effect of CRT on metacognitive insight, and to assess the influence of metacognitive insight on functional recovery in work or education. The first hypothesis states that there is no association between objective and



subjective cognitive functioning. It is expected that objective cognitive functioning and subjective cognitive functioning are independent constructs. The second hypothesis states that there is a positive effect of CRT on metacognitive insight; That is, after CRT there is a higher level of metacognitive insight than before CRT. It is expected that CRT facilitates metacognitive insight, therefore the level of metacognitive insight is higher after training than before training. Moreover, this improvement is only seen in the group receiving CRT. The third hypothesis states that metacognitive insight has a positive association with functional recovery. It is expected that patients who are working or studying have a higher level of metacognitive insight compared to patients who are not working or studying. As noted earlier, Wykes and colleagues (2011) have shown that the facilitation of metacognition in CRT leads to a better functional recovery since it is important in the transfer of new cognitive skills to everyday life.³⁸

Methods

Participants.

The target group of participants consisted of 68 participants from 18 years of age and older. Demographic variables are presented in Table 1 and 2 (see Appendix C). Participants were included when they experienced their first psychosis (defined as a schizophreniform, schizoaffective or reactive psychosis^{1*}) within the past five years, had substantial objective or subjective cognitive problems, and were in treatment of healthcare in an EIP Early Intervention Psychosis (EIP) team. The EIP team provides the participant with the vocational intervention (IPS).

The exclusion criteria were participants who have a limited understanding of the Dutch language, who have an IQ of under the 70 or who experienced a drug or brain damage induced psychosis. Additionally, participants who were participating in other studies that were interfering with the current study were excluded.

^{1*} The main diagnosis was not an inclusion criterion. That is, patients diagnosed with schizophrenia or other psychotic illnesses were included.

**Treatment.**

Included participants were randomly assigned to 2 treatment conditions: IPS + CRT or IPS + placebo-therapy. Both CRT and placebo-therapy starts after the baseline measurement and ends after approximately 3 months.

Individual Placement and Support. The goal of IPS is to offer the participant standardized supported employment to improve, acquire, and maintain independent employment and education in patients with Severe Mental Illnesses.^{5,6} The main focus in this support is on the job or education preferences of the participant and on fast contact with employer of school instead of training first. In practice, this support consists of a mentor who assists the participant to get a job/education, provides support to keep the job/study, and provides help if a participant gets fired or drops out of school. Moreover, vocational activities that contains information from every job- or education experience (i.e. monthly hours spent on work/school, start/end date, and reason of ending if applicable) were monitored.

Cognitive remediation therapy. The goal of CRT is to improve cognitive function and thinking skills of the participants. Participants underwent 40 sessions of therapy in 12 weeks: this includes a therapist-guided session once a week and a self-practice session twice a week followed by evaluation by telephone. Sessions lasted 30-60 minutes and consisted of a number of cognitive tasks (e.g. remembering a word list or planning a journey). Within the computer program, it is expected that metacognitive insight is facilitated through assigning the participant to choose a strategy (from a suggested list or creating a new one), rate the usefulness of the strategy, estimate the time for completing the task before the task and estimate the difficulty of the task before and after the task. The role of the therapists involved discussing task requirements and task performance, and facilitates metacognitive insight by discussing cognitive skills of the participant, usefulness of the strategies, and in which situation in real life these strategies can be applied.

Placebo-therapy. The placebo-therapy was based on the same procedure as CRT. However, instead of cognitive tasks, a set of five interactive games was used (a platform game, a shooting game, a race, a building game and a maze). Intervention was focused on improving game scores. Moreover, topics regarding using cognitive strategies or application of practiced skills in daily life were not discussed during therapy.



Measurements.

Demographic variables. To collect demographic variables, participants were asked questions about their personal circumstances, including questions about living situation (“How do you currently live?” and “With whom do you currently live?”), education level, and how long ago they experienced their first psychosis.

Furthermore, at baseline, an IQ test was administered to assess premorbid functioning (Nederlandse Leestest voor Volwassenen; NLV⁶⁶). Finally, to measure severity of psychotic symptoms, a semi-structured interview was used (Positive and Negative Syndrome Scale; PANSS⁵⁹), whereas an increase in score represents an increase in symptom severity.

Functional recovery. To measure functional recovery, participants had to complete a questionnaire which consist of questions about functioning in work and education. The outcome consists of answers to the following questions: “Are you in a competitive job at this moment?” and “Do you attend regular education at this moment?” and is dichotomous since these questions can only be answered with either “Yes” or “No”.

Subjective cognitive functioning. To measure subjective cognitive functioning, self-reported cognitive failures were measured using the Dutch version of the Cognitive Failure Questionnaire⁴¹ (CFQ). This is a questionnaire consisting of 25 items showing failures during events that could have happened to the participant (e.g. “forgetting appointments” or “accidentally bumping in to someone”). Participants had to answer how often each event had occurred to them in the past four weeks, on a 5-point Likert scale ranging from 0 to 4. The CFQ is a valid measure on subjective cognitive complaints with a good test-retest reliability for groups of individuals and good internal reliability.^{41, 42} The primary outcome is the reversed total CFQ-score, which ranges between 0 and 100. This score is reversed so that a high score indicates low complaints and therefore high subjective cognitive functioning (see Appendix B).

Objective cognitive functioning. To measure objective cognitive functioning, a set of neuropsychological tests was used. All tests and the CFQ were tested on a laptop with the use of the Mental Information Processing and Neuropsychological Diagnostic System⁴³ (MINDS), to integrate different tests for easy assessment and data-transfer.

The Continuous Performance Task⁴⁴ (CPT) measures sustained and selective attention. Different letters were presented one by one in the middle of the screen for fifteen minutes. Participants were instructed to focus on the laptop screen and to press the spacebar when a specific letter combination (“A” and “X”) appeared on the screen. The primary outcome measure is reaction time.



The Word Learning Task⁴⁵ is a measure of verbal long term memory. Fifteen monosyllabic nouns were verbally presented to the participants. Hereafter, participants were instructed to recall as many words as possible. This procedure was repeated four times. Twenty minutes after the last presentation of the words, participants had to recall as many words as possible and perform a recognizing test (delayed recall). The main outcome measures are the total number of correctly remembered words in the immediate and the delayed recall task.

The Wisconsin Card Sorting Task⁴⁶ measures executive functioning. In this task participants were presented with four playing cards and instructed to match a new card with one of the four fixed playing cards. Matching can be based on the type of figure, color of the figure, or number of figures on the card. Participants were not instructed about what kind of matching which had to be implemented during the task. After every match, participants were provided with feedback (correct/incorrect match). The participants were forced to apply the appropriate matching strategy and switch adequately between strategies when another matching strategy should be applied. The main outcome measure is number of errors made after a strategy switch (perseverative errors).

The Trail Making Test⁴⁷ is a measure of visual processing, attention and executive functioning. The test consists of three separate trials. In the first trial (trial A) participants were instructed to connect a sequence of encircled numbers in the right order. In the second trial (trial B) participant had to connect a sequence of letters in alphabetic order. In the third trial (trial C) the participants were instructed to alternate between numbers and letters (1, A, 2, B, etc.). The outcome measure is the time to complete each trial and the time difference between trial C and trial A and B.

The digit span forward and backward from the Wechsler Adult Intelligence Scale⁴⁸ (WAIS) measures working memory. In this task, an increasing amount of digits was presented on the computer screen. After each presentation the participants were instructed to recall the presented digits in the same order (forward) or in reversed order (backward). The outcome measure is the number of correct recalls in each condition.

Metacognitive insight. To measure metacognitive insight, a new variable was composed of the difference between objective cognitive functioning and subjective cognitive functioning. Scores range from 0-100, where high scores indicate high metacognitive insight.

**Procedure.**

Participants who fitted the inclusion criteria were asked to participate by their case manager. The case manager is also the person who informs the participant about the study. If the participant was willing to participate, an informed consent was signed and sent to Kenniscentrum Phrenos. The research assistant contacted the participant to make an appointment for the baseline measurement. All measurements were held at the GGZ-location where the participant is under treatment. All participants went through three sessions: T0 (baseline), T1 (6 months after baseline) and T2 (18 months after baseline- all participants have completed training), due to the best response rate at indicated time points.^{49, 50} In each session, participants were briefed (see Appendix A), after which the measurement starts. A measurement lasted approximately 2 to 2,5 hours and consisted of a personal situation questionnaire, a work and education questionnaire, the NLV⁶⁶ (assessed during baseline), the cognitive test battery on a laptop, tree pen and paper questionnaires (Mental Functioning, Self-Stigma and Empowerment) and the PANSS.⁵⁹ After the measurement, the participants were given a coupon as a reward for participation.

Statistical analysis.

Statistical data analyses were performed using SPSS version 22.0 (IBM Corp, 2013).⁵¹ The significance threshold was set at $\alpha = .05$. The first hypothesis stated that there is no significant association between objective cognitive functioning and subjective cognitive functioning before CRT. To test this hypothesis, a correlation analysis was performed on objective cognitive functioning and subjective cognitive functioning. To measure objective cognitive functioning, a percentile score was composed of each cognitive test in the cognitive test battery based on the normative data of the psychotic population. A composite score was compiled of the average percentile score of all cognitive tests at T0. To measure subjective cognitive functioning, a total score of the CFQ at T0 was used. Expected was a non-significant correlation between the cognitive composite score and CFQ-score.



The second hypothesis stated that there is an effect of CRT on metacognitive insight. To test this hypothesis, a Mixed ANOVA was performed with the independent between-subject variable intervention, measured on two levels (CRT or control) and the independent within-subject variable time, measured on three levels (T0, T1, T2) and the dependent variable metacognitive insight. The variable metacognitive insight was composed of a difference score between the cognitive composite score and a reversed CFQ-score. The CFQ-score was reversed because a high complaints score is considered as subjective cognitive impairment, whereas a low complaints score is considered as subjective cognitive functioning. Also the difference score between subjective cognitive functioning and objective cognitive functioning was reversed so that a low difference score represents a high level of metacognitive score. Expected is a main effect of time: that is, there is a higher level of metacognitive insight after the training (T2) in comparison with baseline. Moreover, expected is an interaction effect between intervention and time: in the CRT-condition there is a significant stronger effect of time in comparison with the control condition.

The third hypothesis stated that high metacognitive insight, the independent variable, is associated with high functional recovery, the dependent variable. A logistic regression analysis was applied to assess the influence of metacognitive insight, a continuous variable, on functional recovery, a dichotomous variable. To provide the best possible power, data at T0 is used. Expected was that a small difference score is associated with vocational activity (currently working or studying) and that a big difference score is associated with no vocational activity.

Results

Demographics.

Sixty-eight participants were included in this study; 51 participants were male; 17 participants were female. The mean age of the participants was 27 years ($SD = 5.8$). The number of participants taking psychotropic medications at the time of the study was 63 (93%). With respect to psychotic symptoms, participants showed at baseline a mean Positive Symptom score of 10.6, a Negative Symptom score of 13.2, and a General Psychopathology score of 26.2, which is classified as 'low' on psychopathology.

In total, 25 participants fully completed the study (T0 - T2); 10 participants received CRT and 15 participants received placebo-therapy. Demographic variables of the participants are presented in Table 1 and Table 2 (see Appendix C).



Objective cognitive functioning and subjective cognitive functioning.

To investigate the linear relation between objective cognitive functioning and subjective cognitive functioning, a bivariate Pearson's correlation coefficient (r) was calculated on baseline measurements. Due to the assumption of independent observations, only data at T0 was used. In total, four outliers have been identified through a boxplot (deleted if score is at minimal one and one-half times the interquartile range; identified by a dot or a star), and removed. Shapiro-Wilks test was not significant, indicating that the assumption of normality was not violated. A scatterplot showed that scores were concentrated about the zero-point and distributed in a rectangular pattern: thus, the assumptions of linearity and homoscedasticity were not violated. The bivariate correlation between objective cognitive functioning and subjective cognitive functioning was not significant, $r(68) = -.061$, $p = .621$.

Metacognitive insight.

A Mixed Model ANOVA was used to assess the effect of time and intervention on metacognitive insight. In total, two outliers have been identified through a boxplot and removed. Shapiro-Wilks test was significant in the control group at T1 ($W(15) = .846$, $p < .05$). However, a Mixed Model ANOVA is considered robust against minor violations of normality. Supplementary visual inspection of a Q-Q plot of the control group at T1 indicated that the data in this group was normal distributed; the plotted values did not deviate substantially from the straight line. Taking this into account, it can be concluded that the assumption of normality was not violated. Levene's Test for Equality of Variances was not significant, indicating that the assumption of homogeneity of variances was not violated. Mauchly's Test of Sphericity was not significant, indicating that the assumption of Sphericity was not violated. There was no significant effect of intervention on metacognitive insight, $F(1, 23) = .501$, $p = .486$. There was no significant effect of time on metacognitive insight, $F(2, 46) = .328$, $p = .722$. There was no significant interaction effect between intervention and time, $F(2, 46) = .028$, $p = .973$. Results from the Mixed Model ANOVA are presented in Figure 1 and Table 3 (see Appendix C).

Functional recovery.

A logistic regression was performed to assess the effect of metacognitive insight on functional recovery. Due to the assumption of independent observations, only data at T0 could be used. In total, four outliers were identified through a boxplot, and removed. The logistic regression model was not statistically significant, $\chi^2(1) = 2.68$, $p = .102$. In total, 21 participants were working or studying and 47 participants were not working or studying. Table 4 shows the outcomes of the logistic regression analysis (see Appendix C).



Supplemental analyses.

Mixed Model ANOVA

A median split was performed on the level of metacognitive insight ($m = 89$). A Mixed Model ANOVA was used to assess the effect of time and intervention on metacognitive insight in the 'low insight'-group (score ≤ 89). No outliers were detected through a boxplot. Shapiro-Wilks test was not significant, indicating that the assumption of normality was not violated. Levene's Test for Equality of Variances was not significant, indicating that the assumption of homogeneity of variances was not violated. Mauchly's Test of Sphericity was not significant, indicating that the assumption of sphericity was not violated. Contrast revealed that in the CRT group, there was a significant effect of time on metacognitive insight, $F(2, 22) = 8.802$, $p = .002$. Bonferroni corrected post hoc tests revealed that the level of metacognitive insight at T1 ($M = 85.38$, $SD = 11.41$) was significantly higher than T0 ($M = 74.92$, $SD = 10.80$; $p < .05$) and the level of metacognitive insight at T2 ($M = 85.46$, $SD = 11.76$) was significantly higher than T0 ($M = 74.92$, $SD = 10.80$; $p < .01$). Results from the Mixed Model ANOVA are presented in Figure 2 (see Appendix C).

Treatment effect on subjective cognitive functioning

Data was split on type of intervention (CRT vs Control). A paired-samples t-test was conducted to assess the effect of time on subjective cognitive functioning. No outliers have been identified through a boxplot inspection. Shapiro-Wilks test was not significant, indicating that the assumption of normality was not violated. There was no significant difference of subjective cognitive functioning between T0, T1, and T2 in both the CRT and control group.

Subjective cognitive functioning and Psychotic symptoms

To assess the relation between subjective cognitive functioning and psychotic symptoms, a bivariate Pearson's correlation coefficient (r) was calculated on baseline measurements. Due to the assumption of independent observations, only data at T0 was used. No outliers have been identified through a boxplot. Shapiro-Wilks test was not significant, indicating that the assumption of normality was not violated. A scatterplot showed that scores were concentrated about the zero-point and distributed in a rectangular pattern, indicating that the assumptions of linearity and homoscedasticity were not violated. The bivariate correlation between these two variables was significant, $r(68) = -.277$, $p = .022$.



Discussion

The current study investigated the association between objective cognitive functioning and subjective cognitive functioning, assessed the influence of cognitive remediation therapy on metacognitive insight, and assessed the influence of metacognitive insight on functional recovery. The first hypothesis stated that there is no association between objective and subjective cognitive functioning. Findings confirmed the first hypothesis. The second hypothesis stated that there is a positive effect of CRT on metacognitive insight: there is a bigger improvement of metacognitive insight over time in the group receiving CRT in comparison with the control group. Results did not support the second hypothesis. The third hypothesis stated that metacognitive insight has a positive effect on functional recovery: patients who are working or studying have a higher level of metacognitive insight compared to patients who are not working or studying. Outcomes did not support the third hypothesis.

Results illustrate that there is no significant association between objective cognitive functioning and subjective cognitive functioning. These results show that objective cognitive functioning and subjective cognitive functioning are two independent constructs. Indeed, there is a lot of evidence that objective cognitive functioning and subjective cognitive functioning are independent.^{27, 28, 29, 30, 31, 32, 33} Thus, it is possible that metacognitive insight serves as a mediator between these two constructs. That is, participants who have a high metacognitive insight consequently show a low discrepancy between objective and self-reported cognition and participants who have a low metacognitive insight show a high discrepancy between objective and subjective cognitive functioning.

Outcome data showed that there was no significant improvement of metacognitive insight over time in both the CRT and the control group. No significant main effects and no significant interaction effects were found. In this study, cognitive remediation therapy is not effective in improving metacognitive insight. This implies the rejection of the underlying theory that CRT facilitates metacognitive insight by teaching patients to use conscious cognitive strategies tailored to their abilities.

However, Nakagami and colleagues (2008), pointed out that that intrinsic motivation is vital to strategies used for improving functional levels of patients with psychotic illnesses. In their model, intrinsic motivation act as a mediator between cognition and psychosocial functioning.⁵² It is shown that motivation is necessary for learning processes such as strategy learning. Berridge (2004) argued that psychotic illnesses are associated with a physiologically based decrease in motivation due to disturbed dopamine system and will influence whether



patients initiate or sustain learning behavior (here: initiating practice of cognitive strategies in real life).⁵³ To summarize, the fact that there is no effect of training on metacognitive insight can, in line with the statements of Nakami and colleagues (2006) and Berridge (2004), be explained by a low level of intrinsic motivation in the participant group. In further studies, motivation should be included in the analysis to clarify the impact of this factor. Moreover, further research should incorporate new techniques to improve intrinsic motivation in the patient-group such as minimizing the impact of external motivation (such as payment for participating) and acknowledging and stimulating the patient's autonomy. This may involve creating more responsibility for the patients in the training program like choosing personally engaging tasks or tasks features.^{54, 55} Cordova and Lepper (1996) suggested that patients with schizophrenia indeed have a motivational system which is malleable, and responsive to the same factors enhancing intrinsic motivation as healthy subjects.⁵⁶

Secondly, findings can be explained by a ceiling-effect of metacognitive insight in the sample. That is, the mean metacognitive insight score of the included participants was higher than expected ($M = 84.8$ of 100); this subgroup may have responded differently to CRT than a more heterogeneous group. Possibly, there was not enough room for improvement of metacognitive insight in our participant group due to a ceiling effect. In general, patients with schizophrenia have a low level of (meta)cognitive insight.^{57, 58} However, patients in present study were classified as 'low' on psychopathology: they showed a mean Positive Symptom score of 10.6, a Negative Symptom score of 13.2, and a General Psychopathology score of 26.2.⁵⁹ Supplementary analysis indicate that psychotic symptoms are negatively associated with subjective cognitive functioning. That is, the more severe the psychotic symptoms were, the more cognitive complaints were reported. Furthermore, when the sample was split on high- and low insight (high score > 89 ; low score ≤ 89), a positive effect of time on metacognitive insight was found. These results support the theory that the fact that the sample in the main analysis showed a different response to CRT than hypothesized, can be due to a ceiling effect. A solution to this problem is to include more severe psychotic patients in the research sample to provide a more heterogeneous and representative group. However, in practice more severe psychotic patients are less likely to participate in research due to high mental stress. This difficulty should be recognized in future research.



Finally, findings showed that the group who was employed did not have significant different metacognitive insight scores as the group who was not employed. Possibly, metacognitive insight is not a predictor for functional recovery.

As illustrated before, Wykes and Reeder (2006) stated that metacognition mediates the relation between cognition and vocational functioning.³⁷ However, it is suggested that the relation between cognition and functional recovery can be explained by other factors. In the model of Green (2000), learning potential is dependent on basic neurocognition and indirectly influences vocational outcome by the means of skill acquisition and performance (*Basic neurocognition--> learning potential--> skill acquisition and performance--> vocational outcome*).⁹ Schmidt and colleagues (2011) argued that social cognition (specifically: emotion perception and social knowledge) mediates the relation between cognition and functional outcome. That is, cognitive deficits have an adverse impact on social cognition and thereby have a negative influence on functional outcome (measured using the Global Assessment of Functioning; GAF).⁶⁰ These findings illustrate that cognitive remediation therapies need to be combined with therapies targeting other factors that influence functional recovery. Empirical research on this topic is needed to clarify the relation between these mediators and functional recovery.

Limitations of this study should be acknowledged. Rule of thumb for establishing a good power is to have at least 30 participants included in the sample.⁶² However, due to excluded participants the sample of the Mixed Model ANOVA consisted of only 25 participants. The small sample possibly have led to a low power. Consequently, the study was less able to detect a significant effect when it was present. Moreover, the sampling group of the logistic regression analysis was unequal distributed: 21 participants were working/studying, compared to 47 participants who were not working/studying. According to Field (2013), to establish a good power in a logistic regression analysis states, rule of thumb is that the group of the dichotomous variable should consist of minimal 30 participants.⁶¹ The unequal distribution could have affected the power of present study. Also at T1(6 months after baseline) and T2 (18 months after baseline), data was unequal distributed. However, as the data-sampling continues for ongoing research, the addition of new data will lead to improvement of the power.

The present study is one of the first studies who operationalizes the construct metacognitive insight. In this study, the difference scores between objective test scores and self-reported complaints on the CFQ were used to measure metacognitive insight. The main difficulty with self-reports is that such reports are less quantifiable measurements, thereby self-



reported complaints are difficult in providing conclusions about objective performance. Consequently, one could question if self-reported cognitive problems applied in real life and cognitive problems on a neuropsychological test battery are comparable to each other. Possibly, gaining insight in cognition in real life situations requires more overarching thinking-processes than in computer-tasks and therefore insight in computer-assessed cognitive abilities could differ from insight in real-life situations. In other words, a person who has insight in problems on the cognitive task does not necessarily have to show insight on real-world cognitive problems. Further research could match the questionnaire of subjective cognitive functioning with the objective cognitive test. Questions should be task-related; e.g. participants are asked to rate their cognitive performance after each task, and can be integrated in the computer program. Alternatively, the cognitive test can be matched to activities in daily life; Virtual Reality environments can be used to assess cognitive functions in real life situations.⁶² Furthermore, although the CFQ is a valid measurement to measure self-reported cognitive problems,^{41, 42} there are opposing views about the specific cognitive domains which the questionnaire represents. Broadbent (1982) stated that CFQ is associated with measures problems with perception, memory and motor function. However, other researchers argue that CFQ consists of several other factors (e.g. problems with alertness and sustained attention, verbal fluency, spatial memory, language and intelligence).^{63 64, 65} It is therefore possible that the CFQ measures different cognitive domains as the cognitive test battery does. Future research could use a questionnaire based on the domains used in the (objective) neuropsychological test battery.

To conclude, results direct to the confirmation of the hypothesis that there is no association between objective and subjective cognitive functioning and moreover, to the rejection of the hypothesis that there is an effect of CRT on metacognitive insight and that there is an effect of metacognitive insight on functional recovery. These findings are particularly relevant since currently there is not much known about the role of metacognitive insight in cognitive remediation: Present study contributes to the knowledge about effective cognitive remediation therapies in early psychotic patients. It is recommended for further research to include more participants for a more representative sample, add motivation to the theorized model and compose a new scale for metacognitive insight.



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Appendix A. Briefing participants.

Goedemorgen, (-middag)

Ik ben

Ik werk als interviewer voor het Kenniscentrum Phrenos en het Trimbos-instituut. We doen onderzoek naar de resultaten van verschillende manieren van begeleiden naar betaald werk of studie.

Hartelijk dank dat u mee wilt werken aan dit interview. Het interview bestaat uit verschillende onderdelen en duurt ongeveer 2 tot 2,5 uur. Als u moe bent of graag even pauze neemt, wilt u dat dan zeggen?

We gaan vertrouwelijk om met wat u mij vertelt. Dat wil bijvoorbeeld zeggen dat we niet aan een hulpverlener of anderen doorgeven wat u ons vertelt. Alleen de onderzoekers krijgen de gegevens, maar die kunnen de gegevens niet aan u persoonlijk koppelen. U kunt erop vertrouwen dat we zorgvuldig met de gegevens omgaan.

Als u bij de vragen iets niet begrijpt, heb ik graag dat u dat zegt.

Als u liever geen antwoord wilt geven op een bepaalde vraag, dan kunt u dit altijd aangeven. Heeft u op dit moment nog vragen?

Indien nee: Oké, dan gaan we beginnen.

E SUBJECTIEF COGNITIEF FUNCTIONEREN

LET OP: Deze vragenlijst wordt afgenomen in MINDS (met 4 aanvullende vragen)

De volgende 25 vragen gaan over kleine, alledaagse vergissingen die iedereen van tijd tot

tijd maakt. Sommige van die vergissingen overkomen u waarschijnlijk wat vaker dan andere.

Wij willen graag van u weten in hoeverre deze alledaagse vergissingen bij u zijn voorgekomen in de **afgelopen 4 weken**. Hieronder kunt u kiezen wat het beste bij u past. De mogelijkheden zijn:

‘zeer vaak’, ‘vaak’, ‘af en toe’, ‘zelden’ en ‘nooit’.

		zeer vaak	vaak	af en toe	zelden	nooit
1	Iets lezen en vlak daarna niet meer weten wat u nu gelezen hebt, zodat u het moet overlezen	4	3	2	1	0
2	Vergeten waarom u naar een bepaald gedeelte van uw huis bent gelopen	4	3	2	1	0
3	Wegwijzers over het hoofd zien	4	3	2	1	0
4	Links en rechts verwarren bij het beschrijven van een route	4	3	2	1	0
5	Per ongeluk tegen mensen opbotsen	4	3	2	1	0



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6	Niet meer weten of u het licht of het gas hebt uitgedaan, of de deur hebt afgesloten	4	3	2	1	0
7	Niet luisteren naar de naam van een persoon op het moment dat deze persoon zich aan u voorstelt	4	3	2	1	0
8	Iets er uitflappen en achteraf bedenken dat dat wel eens beledigend voor iemand zou kunnen zijn	4	3	2	1	0
9	Niet merken dat iemand iets tegen u zegt als u met iets anders bezig bent	4	3	2	1	0
10	Boos worden en daar later spijt van hebben	4	3	2	1	0
11	Belangrijke brieven dagenlang onbeantwoord laten	4	3	2	1	0
12	Vergeten welke straat u moet inslaan als u een route kiest die u goed kent, maar zelden gebruikt	4	3	2	1	0
13	In een supermarkt niet kunnen vinden wat u zoekt terwijl het er wel is	4	3	2	1	0
14	U plotseling afvragen of u een woord op de juiste manier gebruikt	4	3	2	1	0



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15	Moeite hebben met het nemen van een beslissing	4	3	2	1	0
16	Afspraken vergeten	4	3	2	1	0
17	Vergeten waar u iets hebt neergelegd, zoals een boek of een krant	4	3	2	1	0
18	Per ongeluk iets weggooien dat u nodig hebt en bewaren wat u weg wilde gooien	4	3	2	1	0
19	Dagdromen terwijl u eigenlijk naar iets of iemand zou moeten luisteren	4	3	2	1	0
20	Namen van mensen vergeten	4	3	2	1	0
21	Beginnen met iets maar het niet afmaken, omdat u ongemerkt met iets anders bent begonnen	4	3	2	1	0
22	Niet op een woord kunnen komen terwijl het 'op het puntje van uw tong' ligt	4	3	2	1	0
23	In een winkel vergeten wat u kwam kopen	4	3	2	1	0
24	Dingen uit uw handen laten vallen	4	3	2	1	0
25	In een gesprek niets meer weten om over te praten	4	3	2	1	0



Appendix C. SPSS Output

Table 1.

Demographic Variables of all Participants at Baseline

	<i>M</i>	<i>SD</i>	<i>N (%)</i>
Age	27	5.84	
<i>Gender</i>			
Male			51 (75%)
Female			17 (25%)
<i>Highest level of education -completed</i>			
Low (basisonderwijs, vmbo, mbo-1, eerste drie jaar havo/vwo)			22 (32.4%)
Middle (havo, vwo, mbo 2-3-4, hbo/wo propedeuse)			35 (51.5%)
High (hbo, wo bachelor, wo master, doctor)			11 (16.2%)
<i>PANSS Scores</i>			
General Psychopathology	26.21	6.98	
Positive Symptoms	10.56	3.55	
Negative Symptoms	13.2	3.98	

**Table 2.***Demographic Variables at Baseline split by Intervention*

	<u>CRT</u>			<u>Control</u>		
	<i>M</i>	<i>SD</i>	<i>N (%)</i>	<i>M</i>	<i>SD</i>	<i>N (%)</i>
Age	28	3.23	10	25	4.7	15
<i>Gender</i>						
Male			8 (80%)			9 (60%)
Female			2 (20%)			6 (40%)
<i>Highest level of education -completed</i>						
Low (basisonderwijs, vmbo, mbo-1, eerste drie jaar havo/vwo)			3 (30%)			2 (13.3%)
Middle (havo, vwo, mbo 2-3-4, hbo/wo propedeuse)			6 (60%)			9 (60%)
High (hbo, wo bachelor, wo master, doctor)			1 (10%)			4 (26.6%)
<i>PANSS Scores</i>						
General Psychopathology	22.1	2.77		25.38	4.69	
Positive Symptoms	8.90	2.33		10.25	3.96	
Negative Symptoms	12.8	3.00		13.88	4.18	



Table 3.

Effect of Intervention on Metacognitive Insight During 18 Months of Treatment (N = 25)

	<u>T0</u>		<u>T1</u>		<u>T2</u>		<i>M_{total}</i>	<i>F</i>	<i>p</i>	<i>N</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
CRT	82.70	14.61	84.60	9.32	85.50	11.88	84.27	.501	.486	10
Control	85.67	12.12	87.33	11.48	87.20	10.86	86.73	.328	.722	15
Total	84.48	12.96	86.24	10.55	86.52	11.07	-	-	-	-

Table 4.

Effect of Metacognitive Insight on Functional Recovery at Baseline (N = 68)

	<i>B (S.E.)</i>	Lower	Odds Ratio	Upper	<i>p</i>
Included					
Constant	2.044 (1.759)		7.719		.245
Metacognitive Insight	-.034 (.021)	.928	.967	1.007	.104

Note: $R^2 = .054$ (Nagelkerke). Model $\chi^2(1) = 2.68, p = .102$.

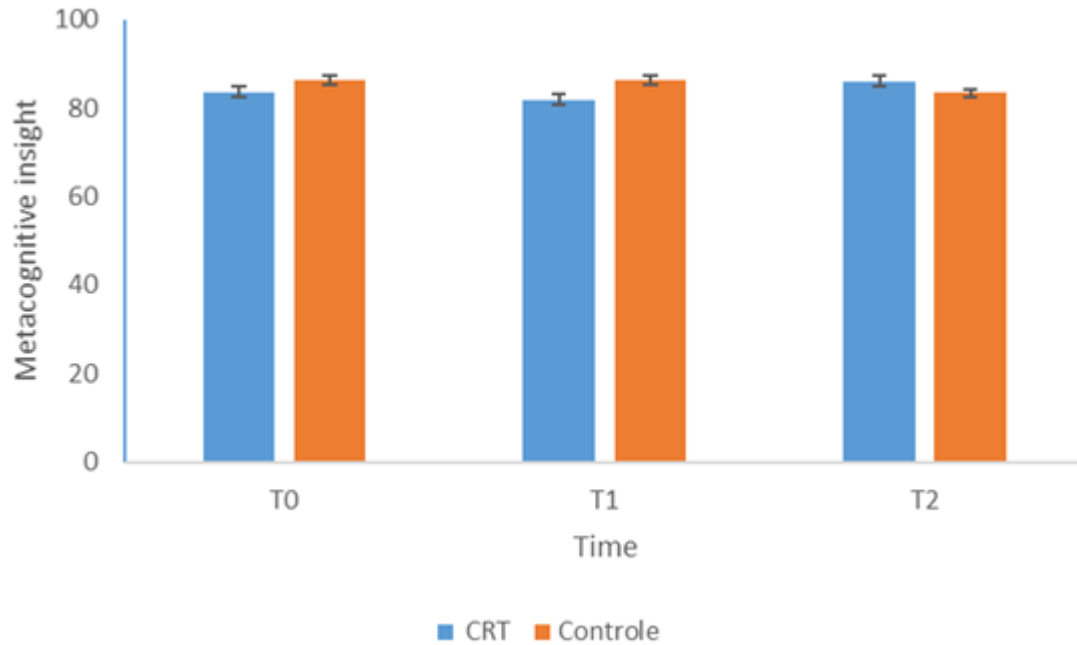


Figure 1. Mean metacognitive insight score in the CRT and control group, at 3 measurement occasions. Error bars represent standard errors.

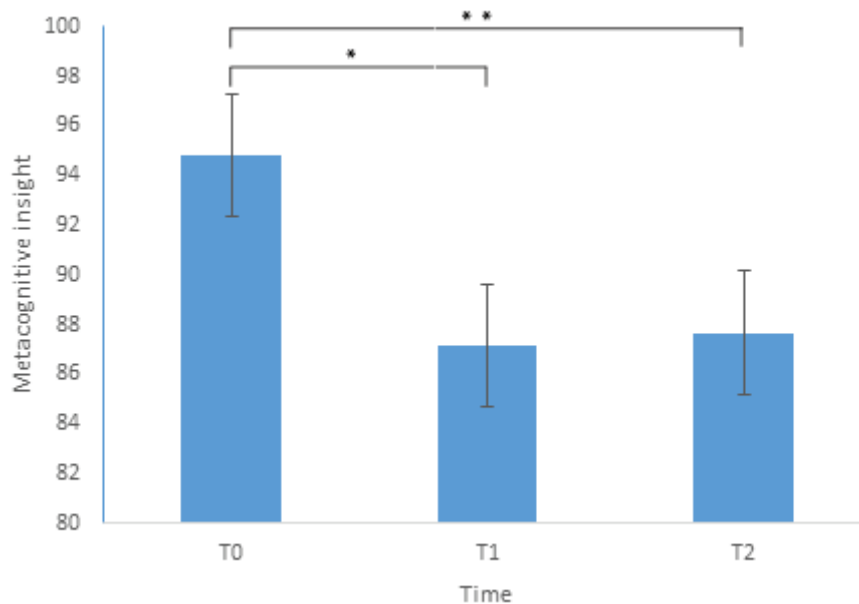


Figure 2. Mean metacognitive insight score in the 'low insight'-group (score ≤ 89) in patients receiving CRT at 3 measurement occasions. Error bars represent standard errors.

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



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