Effect of Strategy Training on Self-Awareness of Deficits After Stroke

Jessica Kersey, Shannon B. Juengst, Elizabeth Skidmore

Importance: *Self-awareness of deficits,* or the ability to understand the effects of impairments on daily life, is often diminished after a stroke. Diminished self-awareness influences participation in rehabilitation and functional outcomes.

Objective: To examine whether self-awareness of deficits changed over time after a stroke (N = 43) and whether metacognitive strategy training (n = 21) resulted in improved self-awareness compared with direct skill training (n = 22).

Design: Secondary analysis of data collected from a randomized controlled trial.

Setting: Inpatient stroke rehabilitation.

Participants: Adults with cognitive impairments after an acute stroke.

Intervention: Metacognitive strategy training is an approach in which clients are guided through a process of self-assessment and develop solutions for barriers to task performance. This approach was compared with direct skill training, in which the therapist provides specific instructions for task completion, removing the client-initiated assessment and problem-solving components.

Outcomes and Measures: Self-awareness measures included the Self-Regulation Skills Interview and Self-Awareness of Deficits Interview at baseline and 3 mo and 6 mo after the intervention. We used a one-way analysis of variance (ANOVA) to analyze change in self-awareness and a two-way ANOVA to examine differences between groups over time.

Results: There was a statistically significant and potentially meaningful difference over time in the self-awareness domain of strategy behavior, $F(2) = 3.35$, $p = .039$, but there were no differences in improvements between the metacognitive strategy and direct skill training groups.

Conclusions and Relevance: Self-awareness warrants further investigation to determine whether it improves naturally over time or through both interventions after stroke.

What This Article Adds: Self-awareness of deficits, and the use of strategies in particular, may improve in the early stages of stroke recovery, but the optimal approach for intervention remains unclear.

Self-awareness of deficits, or the ability to understand the functional impact of injury-related deficits, is often impaired after an acquired brain injury. People with impaired self-awareness engage less in rehabilitation and less often use compensatory strategies (Richardson et al., 2014, 2015; Toglia & Kirk, 2000). Therefore, it is not surprising that impaired self-awareness is associated with low rates of living independently, high rates of family stress, and poor vocational and community outcomes (Richardson et al., 2014, 2015; Toglia & Kirk, 2000).

Crosson et al. (1989) proposed a hierarchical model of self-awareness. The first level, *intellectual awareness,* is the ability to acknowledge impairment of a body function. *Emergent awareness,* the next level, is the ability to use this self-knowledge to identify problems with performance of everyday activities. *Anticipatory awareness,* the highest level of the hierarchy, is the ability to anticipate problems that are likely to occur during activity because of a specific deficit. Toglia and Kirk (2000) expanded on this model to include an element of metacognition. Their Dynamic Comprehensive Model of Awareness emphasizes *online awareness,* an interactive process of performance monitoring and self-regulation during an activity, including the ability to manage environmental and task demands. They also suggested that the components of awareness are less hierarchical and more interdependent.

The multifaceted nature of self-awareness makes it difficult to measure and creates challenges in analyzing its natural trajectory and responsiveness to intervention (Smeets et al., 2012). Research suggests that self-awareness does not improve in the first year after a brain injury without intervention (Cheng & Man, 2006; Doig et al., 2014; Goverover et al., 2007; Richardson et al., 2014). However, the degree to which self-awareness improves, as well as which interventions are most effective, remains unclear. Metacognitive interventions appear to show promise (Cheng & Man, 2006; Doig et al., 2014; Engel et al., 2019; Goverover et al., 2007; Ownsworth et al., 2006; Schmidt et al., 2013; Toglia & Kirk, 2000). These top-down approaches promote conscious cognitive processing, self-regulation, and problem solving in a task-specific context (Engel et al., 2019; Toglia & Kirk, 2000). Clients are guided through a process of self-assessment and are assisted with developing their own solutions for overcoming barriers to task performance. This approach stands in contrast to direct skill training, in which the occupational therapy practitioner provides specific instructions for task completion, removing the client-initiated assessment and problem-solving components and limiting the opportunity for errorful learning (Skidmore et al., 2017).

Some researchers have reported improved intellectual awareness associated with metacognitive interventions (Cheng & Man, 2006; Doig et al., 2014; Goverover et al., 2007), and some have reported improvements in online or task-specific awareness (Engel et al., 2019). However, none have shown generalization of awareness improvements to gains in functional independence or participation. Moreover, no researchers have compared metacognitive interventions to other interventions. Finally, most studies have focused on traumatic brain injury (TBI). Despite the similarities in cognitive deficits after stroke and TBI, little is known about clients' self-awareness of deficits, particularly cognitive deficits, after stroke.

The objectives of this study were to determine whether client self-awareness of deficits improves over time after stroke and whether improvements are greater for clients who receive metacognitive strategy training compared with direct skill training.

Method

This study was a secondary analysis of data from a randomized trial of metacognitive strategy training and direct skill training. Participants with acute stroke and cognitive impairments (Executive Interview–14 item score ≥3; Royall et al., 1992) were enrolled during inpatient rehabilitation. People with substance abuse; psychiatric diagnoses, including major depressive disorder; moderate to severe aphasia; or dementia were excluded. Participants were randomized (using a random numbers table) to receive one of two interventions in addition to usual care. One group received 10 sessions of metacognitive strategy training, and the other group received 10 sessions of direct skill training. Usual care included a minimum of 3 hr of interdisciplinary rehabilitation, at least 5 days/wk. Details of the intervention protocol have been published elsewhere (Skidmore et al., 2017). Blinded assessors, trained and supervised by an experienced occupational therapist, completed baseline testing in inpatient rehabilitation and follow-up testing at 3 mo and 6 mo in the home. Participants and therapists were blinded to the treatment in the nonassigned group.

We examined self-awareness of deficits with the Self-Awareness of Deficits Interview (SADI; Fleming et al., 1996) and the Self-Regulation Skills Interview (SRSI; Ownsworth et al., 2000). Because of the SADI's complexity, we followed the long-standing recommendation to use multiple methods of assessing self-awareness (Fleming et al., 1996). Both measures have established reliability and validity (Fleming et al., 1996; Ownsworth et al., 2000; Smeets et al., 2012) and were administered at baseline (inpatient rehabilitation), 3 mo, and 6 mo. Scores on both tools are based on a clinician's judgment of the participant's awareness. The SADI includes 3 items, each assessing a separate component from Crosson et al.'s (1989) hierarchical model. Each item is measured on a 4-point scale (0 = *no deficit,* 3 = *severe deficit*). For the present analyses, we summed the 3 items to create a SADI Total score that could range from 0 (*no deficit*) to 9 (*severe deficit*). Because there are no published standards to define clinically meaningful change in the SADI Total score, we decided a priori that a 2-point change in the Total score (either 2 points in a single domain or 1 point in two domains) would indicate >20% change in the Total score and thus would be a clinically meaningful change for this analysis.

The SRSI has three subscales: Awareness, Readiness, and Strategy Behavior. Each subscale tests a different construct of awareness, so we analyzed each subscale individually. Similar to the SADI, the SRSI Awareness subscale has 2 items that measure intellectual and emerging awareness, as presented in Crosson et al.'s (1989) model. Each item is scored on a 0–10 scale (0 = *no deficit,* 10 = *severe deficit*). The 2 items of the SRSI Awareness subscale were summed to yield a total score that could range from 0 (*no deficit*) to 20 (*severe deficit*). The SRSI Readiness subscale is a single-item client report of readiness to try new strategies. The item is scored in the inverse of the Awareness subscale (0 = *severe deficit,* 10 = *no deficit*). The SRSI Strategy Behavior subscale assesses the client's ability to actively plan and implement new strategies to compensate for impairments. This subscale reflects the metacognitive element of online awareness that was proposed by Toglia and Kirk (2000). This subscale has 3 items and is scored similarly to the Awareness subscale (0 = *no deficit,* 10 = *severe deficit*) for a total subscale score of 0 (*no deficit*) to 30 (*severe deficit*). We determined that a minimum change of 2 points on each subscale was clinically meaningful, using the same rationale as with the SADI.

We used one-way analyses of variance (ANOVAs) to analyze change in self-awareness over time using the SADI Total score and each of the SRSI subscale scores. Two-way ANOVAs were used to examine differences in self-awareness between groups over time.

Results

Forty-three participants were enrolled, with 21 randomized to metacognitive strategy training and 22 to direct skill training (Table 1). There were no differences between groups in baseline levels of self-awareness, cognition, independence, or stroke severity (see Table 1). Our sample had a slightly milder level of self-awareness deficits at baseline than samples in other studies that have explored these questions (Cheng & Man, 2006; Doig et al., 2014; Goverover et al., 2007). We achieved 86% power based on our established minimal clinically important difference.

Table 2 includes long-term outcomes. The combined sample demonstrated a statistically significant improvement in SADI Total scores from baseline to 6-mo follow-up, $F(2, 93) = 4.51$, $p = .01$, although this difference was not clinically meaningful (mean change = 1.18). There was no difference between groups in SADI Total scores over time, $F(1, 25) = 0.12$, $p = .73$.

The combined sample showed no meaningful improvement on the SRSI Awareness subscale, $F(2, 102) = 1.74$, $p = .18$, or the SRSI Readiness subscale, $F(2, 102) = 0.15$, $p = .86$, and there was no difference between groups over time, $F(2, 54) = 0.42$, $p = .66$; $F(2, 54) = 1.01$, $p = .37$. There was, however, a statistically significant and clinically meaningful improvement on the SRSI Strategy Behavior subscale for both groups over time, $F(2, 102) = 3.35$, $p = .04$. Post hoc tests revealed a statistically significant difference between baseline and Month 3. The Group × Time interaction was not significant, $F(2, 54) = 0.11$, $p = .90$. However, Figure 1 suggests that participants in the strategy training group may have been maintaining improvements in strategy behavior, whereas those in the direct skill training group were not, suggesting greater generalization with strategy training.

Table 1. Participant Characteristics and Group Differences at Baseline

Characteristic	DST (*n* = 22)	MST (*n* = 21)	$\chi^2(df)$ or $t(df)$
Sex, male, *n* (%)	13 (59)	9 (43)	$\chi^2(1) = 1.13$
Age, yr, *M* (*SD*)	66.73 (14.25)	65.86 (11.67)	$t(41) = 0.22$
Race, White, *n* (%)	21 (95)	20 (95)	$\chi^2(1) = 0.00$
Stroke type, ischemic, *n* (%)	14 (64)	14 (67)	$\chi^2(1) = 0.04$
Stroke severity, NIHSS (range = 0–42), *M* (*SD*)[a]	7.86 (5.10)	7.00 (3.90)	$t(41) = 0.62$
Cognitive impairment, EXIT–14 (range = 0–28), *M* (*SD*)[a]	10.86 (5.14)	12.38 (5.11)	$t(41) = 0.97$
FIM®[b] (range = 18–126), *M* (*SD*)	67.32 (18.33)	67.33 (14.72)	$t(41) = 0.00$
SADI (range = 0–9), *M* (*SD*)[a]	3.79 (2.49)	4.25 (3.04)	$t(37) = 0.52$
SRSI			
Awareness (range = 0–20), *M* (*SD*)[a]	12.45 (4.22)	13.57 (4.92)	$t(41) = 0.80$
Readiness (range = 0–10), *M* (*SD*)	9.05 (2.21)	8.05 (3.49)	$t(41) = 0.10$
Strategy Behavior (range = 0–30), *M* (*SD*)[a]	21.14 (6.33)	21.29 (6.58)	$t(41) = 0.08$

Note. *df* = degrees of freedom; DST = direct skill training; EXIT = Executive Interview–14; *M* = mean; MST = metacognitive strategy training; NIHSS = National Institutes of Health Stroke Scale (Williams et al., 2000); SADI = Self-Awareness of Deficits Interview; *SD* = standard deviation, SRSI = Self-Regulation Skills Interview.
[a]Lower scores indicate better performance. [b]Keith et al. (1987).

Discussion

Our findings stand in contrast to those of TBI studies that have reported changes in intellectual awareness only (Cheng & Man, 2006; Doig et al., 2014) and reflect more closely studies that found improvements in online awareness (Engel et al., 2019). The domain of strategy behavior may reflect Toglia and Kirk's (2000) conceptualization of metacognitive or online awareness. We observed changes in this complex skill requiring interaction of all levels of awareness, but no changes in simpler forms of self-awareness. This may lend support to Toglia and Kirk's theory that the domains of self-awareness are less hierarchical and more interdependent. With a small sample size and no control group, it is difficult to confidently identify the reason for the differences in results; instead, we pose several hypotheses that each warrant further exploration in future work.

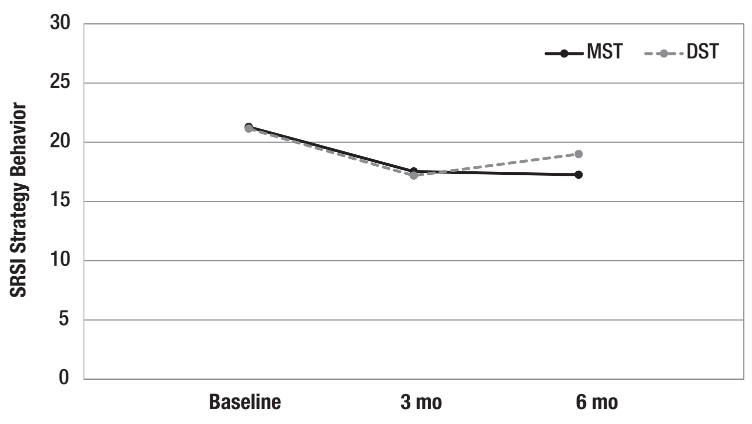
Given the lack of difference between groups, the overall improvement in strategy behavior may be the result of the interventions studied. Both groups participated in top-down training in the context of functional tasks. Thus, both approaches may have driven improvement in function-based online awareness, instead of individual levels of awareness, building skills from the top down. Although metacognitive strategy training shows promise for improving independence among people with cognitive impairments after stroke (Skidmore et al., 2017), it may not be superior in improving self-awareness per se. The key elements driving this improvement may be those present in both interventions, including a top-down, skill-based approach; a task-specific context; and therapist feedback in any form (direct instruction or guided discovery) to promote error awareness. These elements were

Table 2. Awareness Scores, by Group and Time

Measure	Baseline, *M* (*SD*)			3 Mo, *M* (*SD*)			6 Mo, *M* (*SD*)		
	All	DST	MST	All	DST	MST	All	DST	MST
SADI Total	4.03 (2.76)	3.79 (2.49)	4.25 (3.04)	2.85 (2.41)	2.24 (2.44)	3.50 (2.28)	2.30 (2.07)	2.00 (1.66)	2.69 (2.53)
SRSI									
Awareness	13.00 (4.56)	12.45 (4.22)	13.57 (4.92)	11.06 (4.91)	10.94 (4.39)	11.20 (5.58)	11.60 (4.55)	12.00 (5.24)	11.29 (4.07)
Readiness	8.56 (2.91)	9.05 (2.21)	8.05 (3.49)	8.59 (2.17)	9.24 (1.03)	7.78 (2.85)	8.87 (2.24)	8.31 (3.01)	9.29 (1.36)
Strategy Behavior	21.21 (6.33)	21.14 (6.33)	21.29 (6.58)	17.34 (7.46)	17.18 (6.92)	17.53 (8.28)	18.00 (7.32)	19.00 (8.45)	17.24 (6.50)

Note. DST = direct skill training; *M* = mean; MST = metacognitive strategy training; SADI = Self-Awareness of Deficits Interview; *SD* = standard deviation; SRSI = Self-Regulation Skills Interview. See Table 1 for score ranges and interpretation.

Figure 1. Strategy behavior improvements by group.



Note. DST = direct skill training; MST = metacognitive strategy training; SRSI = Self-Regulation Skills Interview (range = 0–30; lower scores indicate greater strategy use).

common in other studies that have demonstrated improved self-awareness after TBI, which lends strength to this hypothesis (Cheng & Man, 2006; Doig et al., 2014; Engel et al., 2019; Goverover et al., 2007; Ownsworth et al., 2006). Therefore, these are elements that should be considered in the delivery of occupational therapy services.

Our findings also suggest that, contrary to the current literature (Richardson et al., 2015; Toglia & Kirk, 2000), it may be possible to achieve functional improvements without improvements in self-awareness. Previous studies have suggested that strategy training may promote greater improvements in performance of activities of daily living compared with direct skill training (Engel et al., 2019; Skidmore et al., 2017). Although we are unable to know with certainty what drives this change in the absence of self-awareness improvements, we have several hypotheses. It may be that strategy training promotes implicit learning, contributing to functional improvements but not to an ability to explicitly identify deficits. It is also possible that strategy behavior itself is what drives changes in functional independence, instead of more foundational components of self-awareness. This would implicate strategy behavior as a primary target for intervention. Finally, it is possible that self-awareness actually is improving along with functional independence but these improvements are not being identified because of challenges with measurement, such as limited construct validity, low sensitivity to change, and low ceiling effects, given that our participants had relatively minor baseline impairments.

An alternative interpretation of these results could be that neither intervention promoted the change in strategy behavior; instead, this could be a natural improvement that would have occurred without intervention as the participants began to see the need for strategies during participation in rehabilitation and transition into the community. However, our finding that the strategy training group maintained improvements in strategy behavior over time and the direct skill training group showed a slight decline suggests that this may not be the case in this sample. Our study lacked a no-treatment control, thereby prohibiting any conclusions we can draw about these interventions relative to natural recovery. Further investigation is warranted.

Limitations

This study has several limitations. First, we did not have a control group, so whether changes would have occurred naturally is unclear. Second, challenges remain in the measurement of self-awareness. The SADI has weak sensitivity to change, requiring dramatic improvement to achieve a numeric change (Richardson et al., 2015; Smeets et al., 2012). Alternative methods have flaws in reliability, sensitivity, or construct validity (Smeets et al., 2012). We decided that the use of two validated measures was the most reliable means of measurement. Our sample's mild baseline impairments may have limited the ability to detect significant improvements with these tools. Finally, there was significant variability in self-awareness within groups at all time points. A larger sample may have reduced the variability; however, this variability may reflect the nature of the stroke population and highlights the importance of a generalizable therapeutic approach.

Implications for Occupational Therapy Practice

Although much about the nature of self-awareness deficits in people with cognitive impairments after stroke continues to be unclear, this study clarifies that self-awareness may improve slightly in the early stages of recovery, particularly in the domain of online awareness, that is, strategy behavior. However, because of the small magnitude of that change, along with the lack of change in other self-awareness domains, occupational therapists may want to consider a multifaceted approach to address this deficit. A metacognitive approach might be used as a remedial strategy, whereas environmental supports and caregiver training might be used to compensate for impairments during the slow recovery process. Further exploration of strategy training's effects on self-awareness is warranted to better understand this phenomenon.

Conclusion

Self-awareness of deficits, and online awareness in particular, may improve in the acute stages of stroke recovery. However, the optimal intervention approach remains unclear. More work is required to better identify potent interventions for improving self-awareness after acquired brain injury.

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Jessica Kersey, MOT, OTR/L, is Occupational Therapist and Doctoral Student, Department of Occupational Therapy, School of Health and Rehabilitation Services, University of Pittsburgh, Pittsburgh, PA; jmk286@pitt.edu

Shannon B. Juengst, PhD, CRC, is Assistant Professor, Department of Physical Medicine and Rehabilitation and Department of Rehabilitation Counseling, University of Texas Southwestern Medical Center, Dallas.

Elizabeth Skidmore, PhD, OTR/L, is Professor and Chair, Department of Occupational Therapy, School of Health and Rehabilitation Services, University of Pittsburgh, Pittsburgh, PA.

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