Application of the Multicontextual Approach in Promoting Learning and Transfer of Strategy Use in an Individual With TBI and Executive Dysfunction

Joan Toglia, Yael Goverover, Mark V. Johnston, Barry Dain

doi:

**key words:** metacognition, strategy use, cognitive rehabilitation

**ABSTRACT**

The multicontext approach addresses strategy use and self-monitoring skills within activities and contexts that are systematically varied to facilitate transfer of learning. This article illustrates the application of the multicontext approach by presenting a case study of an adult who is 5 years post-traumatic brain injury with executive dysfunction and limited awareness. A single case study design with repeated pre-post measures was used. Methods to monitor strategy generation and specific awareness within intervention are described. Findings suggest improved functional performance and generalization of use of an external strategy despite absence of changes in general self-awareness of deficits. This case describes the multicontext intervention process and provides clinical suggestions for working with individuals with serious deficits in awareness and executive dysfunction following traumatic brain injury.

Traumatic brain injury (TBI) is a leading cause of disability in individuals younger than 35 years (Sosin, Sniezek, & Thurman, 1996). Approximately 80,000 to 90,000 individuals are currently experiencing long-term physical and cognitive disabilities due to their TBI (Centers for Disease Control and Prevention, 2003). Some of the most persistent cognitive impairments following a TBI are deficits in attention, memory, and executive functioning (Cicerone, Levin, Malec, Stuss, & Whyte, 2006; Eslinger, Zappala, Chakara, & Barrett, 2007). Executive dysfunction leads to significant functional consequences because people have difficulty self-monitoring performance on a task and managing and efficiently completing multiple step tasks (Cicerone & Giacino, 1992). They also have difficulty dealing with new tasks and/or choosing strategic methods to perform them (McDonald, Flashman, & Saykin, 2002).

Rehabilitation for executive dysfunction following TBI includes training in compensatory strategies. External strategies, such as a checklist, reduce the load on working memory, decrease impulsive actions, enhance task organization, and support the ability to shift from one step of the task to the next. Although checklists are commonly used in occupational therapy practice (Nelson & Lenhart, 1996; Schwartz, 1995), only a few studies have investigated their use in improving func-
tional performance in cognitive rehabilitation (Burke, Zencius, Wesolowski, & Doubleday, 1991). The focus of these studies has involved learning a specific task or routine using principles such as fading cues or errorless learning (Burke et al., 1991; Schwartz, 1995). Burke et al. (1991) reported that checklists reduced the amount of prompting required for vocational routines and found that they were withdrawn without deterioration of performance. Although checklists can be used effectively for task-specific training, they also have the potential to be used and transferred across a wide variety of tasks and situations.

The multicontext approach is designed to enhance function by promoting generalization and transfer by training strategies across a wide range of activities and contexts to enhance function (Toglia, 1991, 2005). The approach acknowledges that an individual must recognize the need to employ a strategy and monitor his or her performance during the activity. The multicontext approach emphasizes the need to place greater demands on generalization of learning by systematically changing the intervention activities and context (Toglia, 2003). It emphasizes helping individuals learn to recognize, monitor, and manage task errors within the context of an activity, and on increasing efficiency and effectiveness of strategy use and self-monitoring skills across a wide range of purposeful and occupation-based activities rather than on improving task-specific skills or impairments. Components of the multicontext approach have been described previously (Toglia, 2003, 2005; Toglia, Johnston, Goverover, & Dain, 2010).

This article demonstrates the application of the multicontext approach as it was applied to an individual with TBI who, although 5 years post-injury, continued to experience executive functioning deficits. She ambulated with a walker due to a recent hip fracture and was classified as having a moderate level of disability as measured by the Disability Rating Scale (Rappaport, Hall, Hopkins, Belleza, & Cope, 1982). RC lived in an apartment with a 24-hour aide and attended a specialized day program. She was not receiving occupational therapy services prior to the study. RC spent most of her time at home watching TV or playing computer games. Her interests included shopping, music, and watching movies. Her personal goals included being able to walk and speak more clearly. She denied other functional or cognitive difficulties.

**Methods**

**Design**

This case study used a single-subject design with repeated measures pre-intervention and post-intervention. The participant was evaluated 4 weeks prior to intervention and immediately before intervention to establish a stable baseline. Measures were collected immediately after a nine-session intervention phase (posttest 1) and again 4 weeks after intervention (posttest 2). This case was part of a larger case series (Toglia et al., 2010).

**Participant**

The participant was recruited from a community day program for individuals with acquired brain injury. Inclusion criteria required the participant to be at least 6 months post-TBI, be independent in self-care activities, have difficulty managing multi-step instrumental activities of daily living (IADL), report no intervention of substance abuse or hospitalization for psychiatric disorder, and be competent to provide informed consent.

**Participant Background information**

The participant, RC, was a 29-year-old woman who sustained a closed head injury with anoxic encephalopathy and frontal lobe dysfunction 5.5 years previously. Prior to the accident, she worked as a manager in a woman’s clothing store and was attending community college. RC demonstrated functional use of both upper extremities with mild fine motor deficits. She ambulated with a walker due to a recent hip fracture and was classified as having a moderate level of disability as measured by the Disability Rating Scale (Rappaport, Hall, Hopkins, Belleza, & Cope, 1982). RC lived in an apartment with a 24-hour aide and attended a specialized day program. She was not receiving occupational therapy services prior to the study. RC spent most of her time at home watching TV or playing computer games. Her interests included shopping, music, and watching movies. Her personal goals included being able to walk and speak more clearly. She denied other functional or cognitive difficulties.

**Measures**

The measures used in this study at baseline and post-intervention phases are presented in Table 1. The informant for the questionnaire was a staff member at the community day program who had known RC for at least 2 years.

**Procedure**

The project was approved by the institutional ethical review board and written informed consent was obtained from RC prior to participation. The intervention protocol included nine 75-minute intervention sessions at a day program that were scheduled twice per week over 5 weeks. Each intervention
session consisted of multiple-step everyday activities and included metacognitive techniques. Responses to questions that focused on identification of challenges and strategy generation were recorded within each intervention session during pre-activity and post-activity discussions and rated on a scale designed for use in this study. Questions were worded in a nonconfrontational manner and avoided directly asking about “difficulties” (e.g., “What types of challenges did you run into as you did this activity?”). Errors were not directly pointed out. Instead, intervention focused on a self-discovery and mediation process that encouraged self-assessment and strategic thinking. Prior to activities, RC was encouraged to identify strategies herself by responding to questions that became progressively specific. At the end of each session, structured self-evaluations and journaling methods were used.

The activities in the first four sessions were chosen by the examiner and structured according to the multicontext horizontal continuum. The initial sessions included activities involving food preparation such as making cookies and fruit salad and planning meals. Activities gradually transitioned from kitchen activities to include other activities such as scheduling appointments on a calendar or making a collage. The intervention protocol and activities are further described elsewhere (Toglia et al., 2010). Within the last five sessions, RC was asked to suggest activities for each of the intervention sessions. However, she only suggested playing computer games. When asked about meal preparation or household activities, she indicated she was not interested. Therefore, RC was asked to choose activities from a prepared list of multi-step activities related to her interests.

Results

Pre-Intervention and Baseline Performance

Table 2 presents results of pretest and posttest measures. At baseline, RC presented with severe deficits in awareness as measured by both the Self-regulation Skills Interview (SRSI) and Awareness Questionnaire (AQ). Informant ratings of the Behavior Rating Inventory of Executive Function (BRIEF) indicated everyday difficulties in planning, organizing, task monitoring, and shifting.

In addition, performance on the Multiple Errands Test (MET) and the Executive Function Performance Test (EFPT) was characterized by a lack of preplanning and a tendency to perform steps partially or omit them entirely. For example, after receiving directions for the MET, RC immediately jumped into the task without reviewing the list. She impulsively purchased several items in a gift shop and had to

<table>
<thead>
<tr>
<th>Domain of Function</th>
<th>Test</th>
<th>Dependent Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-awareness and self-regulation</td>
<td>Self-Regulation Skills Interview (Ownsworth, McFarland, &amp; Young, 2000)</td>
<td>Scores are summed and averaged within the strategy and awareness subscales and range from 0 (high) to 10 (low).</td>
</tr>
<tr>
<td>Self-awareness and self-regulation</td>
<td>The Awareness Questionnaire (Sherer et al., 1998)</td>
<td>The informant’s ratings of the individual’s functioning are summed and subtracted from the individual’s self-rating. The higher the difference scores, the greater the unawareness.</td>
</tr>
<tr>
<td>Functional performance (executive domains); informant report</td>
<td>Behavior Rating Inventory of Executive Function: Adult Version (Roth, Isquith, &amp; Gioia, 2005)</td>
<td>A higher score indicates greater difficulty reported by an informant. Scores of 65 or greater are considered clinically significant for executive function impairments.</td>
</tr>
<tr>
<td>Functional performance (executive domains)</td>
<td>Adapted Version of The Multiple Errands Task (Alderman, Burgess, Knight, &amp; Henman, 2003)</td>
<td>Number of tasks completed accurately (out of 12 tasks) with scores ranging from 0 to 12. A higher score indicates greater completion of tasks.</td>
</tr>
<tr>
<td>Functional performance (executive domains)</td>
<td>Executive Function Performance Test: Bill Paying Subtest (Baum, Morrison, Hahn, &amp; Edwards, 2008)</td>
<td>Scores range from 0 (independent) to 25 (participant cannot perform the task).</td>
</tr>
<tr>
<td>Task-specific self-awareness (created for this study)</td>
<td>Ratings of specific awareness (The scale reflects ability to identify challenges and is available from first author by request).</td>
<td>Responses categorized on a scale ranging from 1 (acknowledged specific difficulties with general questioning) to 6 (no difficulties identified).</td>
</tr>
<tr>
<td>Task-specific self-awareness (created for this study)</td>
<td>Difficulties in strategy generation (Scale available from first author by request).</td>
<td>Responses categorized on a scale ranging from 1 (independently generates specific strategies) to 5 (unable to generate a strategy).</td>
</tr>
</tbody>
</table>
revisit the gift shop twice to complete purchases. In some instances, she performed steps incorrectly, such as purchasing an item rather than determining its price.

Other tasks were partially completed, such as addressing a letter but failing to mail it. During both MET baseline assessments, RC only completed two to three tasks out of 12 accurately and only marked the list two to three times. On the EFPT bill paying task, RC placed the bills in the envelope before recording required information, such as the mailing address and balance due. She became sidetracked by distracters (letter from credit card company) and needed cues for redirection. During assessment, RC easily withdrew from functional tasks when they became challenging. She blamed her difficulties on task deficiencies (e.g., bills were not the same as her bills) and denied problems in attention, memory, or thinking.

**Intervention**

Table 3 illustrates changes in participant responses to metacognitive questions asked before and after intervention activities. Changes in awareness and strategy use were observed across three phases of the intervention process. In phase 1 (sessions 1 to 3), initial emergence of awareness for specific task components and use of the checklist strategy was observed. Phase 2 (sessions 4 to 6) resulted in changes in strategy generation, self-monitoring, and strategy
use, whereas during phase 3 (sessions 7 to 9), RC demonstrated greater initiation of strategy use and generalization.

**Intervention Phase 1 (Sessions 1 to 3)**

At the beginning of intervention, RC was unable to anticipate challenges or generate strategies prior to activities. She readily agreed that a list would be helpful, but as she became involved in activities she strayed away from the list. For example, instructions for baking cookies required placing 10 cookies on a large baking sheet and five cookies on a small baking sheet with a specified number of chips or nuts. Although RC read the directions and checked the first two steps on the list, she failed to go back to the list and never checked the specified amounts of cookies, ingredients, or baking time. She did not set a timer or note the time the cookies were placed in the oven. RC realized she forgot to consider the baking time after the cookies almost burned. During the post-activity discussion, she stated that the cookie dough was too sticky but denied other difficulties. However, specific awareness was observed only when questions about task components were asked. For example, with targeted questions, she acknowledged that she lost track of the cookies in the oven.

Once task-specific challenges were identified, RC was encouraged to think of methods that she could use to ensure success. In the session journal, RC wrote that she should use a timer and look at the directions more carefully. Over the next two sessions, positive reinforcement was provided each time the list was checked. Frequency of list use increased to approximately 40% by the third session. At the third session, RC was able to identify the need to use a checklist for the first time (with specific questions).

**Intervention Phase 2 (Sessions 3 to 6)**

As intervention sessions progressed, RC began to generally predict that activities might be challenging and identified the need for a checklist strategy (with prompts). During activities, the therapist mediated performance if RC began to stray away from the list by asking questions such as, “Let’s stop and check how well the checklist is working. Is there anything that you could do differently?” Consistent use of the checklist increased to 95% during this phase as RC began to realize that she had a tendency to forget about the list. She began to slow down, check herself more frequently, and monitor her tendency to get sidetracked. At sessions 5 and 6, she frequently made comments aloud such as, “I almost forgot to look at the list.” As she encountered problems, she began to ask for help, saying, “I’m stuck; I need help,” rather than, “I quit.” During post-activity discussions at sessions 5 and 6, she identified challenges in remembering to check the list with general questions. Although consistency of checking and marking the list increased, task errors were still observed. She often checked items off the list before they were completed and read the list quickly, missing key details.

**Intervention Phase 3 (Sessions 7 to 9)**

In the last phase of intervention (sessions 7 to 9), RC became more aware of her difficulties and independent strategy use was observed. For example, she spontaneously asked for a checklist when presented with multiple step directions. Although she continued to demonstrate occasional errors, self-monitoring improved and she spontaneously began to underline and circle key details on the checklist. Generalization of use of the checklist was also observed. After session 7, she initiated making her own checklist at home for a craft activity she wanted to complete and brought it in for use during an intervention session. She was actively engaged in intervention activities and often did not want to stop at the end of the session. While writing in her journal during session 8, she indicated that a checklist would be helpful during grocery shopping because she typically thought about what she needed while she was in the store.

In addition to generalization of strategy use, RC began to self-identify personal goals. For example, she indicated that her goals were to learn additional computer skills, learn digital photography, and use the computer for shopping and communicating with others. She expressed the desire to socialize more with others and to live with more privacy and less assistance.

Overall, on a scale of 1 to 10 (highest), RC rated her satisfaction with the intervention program with a rating of 9, whereas she gave a rating of 8.5 to overall benefit of the program.

**Post-Intervention Assessment and Functional Performance (IADL)**

Table 2 presents results at baseline and post-intervention for RC. Immediately following intervention, functional performance improved as indicated by EFPT and MET scores (objective performance measures) and by the BRIEF (informant report based on observation). On the MET, RC’s score changed by 7 points. This change reflects increased planning and frequency of strategy use on the MET. On post-intervention phase 1 of the MET, RC spent 3.5 minutes looking at the list and drew arrows to order how she would complete the first few items. She also checked
off the list 10 times. This was a change from baseline performance when no planning was observed and the list was checked off only twice.

Scores on the EFPT improved substantially. RC scored 12 and 10 at baseline and her scores decreased to 0 (independence) and 2 (minimal cues) post-intervention. The informant ratings on the posttest BRIEF also reflect improvement (of approximately 10 points) in everyday executive function behaviors. Slight changes in awareness and strategy use as reflected by SRSI scores were also observed. No changes were noted on the AQ scores or the discrepancy between self-rating of the BRIEF and informant ratings on the BRIEF.

**Follow-up**

After 4 weeks (posttest 2), inconsistent use of the checklist strategy was observed and a trend toward return to baseline on all measures was observed. For example, on posttest 2 of the MET, RC spent time reordering the list for the first few items, but she did not review the list carefully or follow the order she had planned. However, her performance remained substantially above baseline. After 4 weeks, RC was able to recall many of the intervention activities and sessions in detail. She indicated that the checklist strategy helped her, although she acknowledged that she was not consistently using it.

**Discussion**

This case study demonstrates successful application of the multicontext approach in teaching strategy use across different tasks and contexts with an individual 5 years post-TBI who had substantial impairments in executive functions, self-awareness, and occupational performance. Some intervention approaches assume that generalization of learning cannot occur, particularly with individuals who are several years post-brain injury (Mayer, Keating, & Rapp, 1986; Parish & Oddy, 2007). This case illustrates that if intervention activities are structured with generalization in mind, transfer of strategy use may be possible even 5 years post-injury.

This case study also demonstrates that an individual with executive dysfunction needs practice to learn to use a strategy effectively. As observed in this study, during baseline evaluations and initial intervention sessions, provision of a checklist alone did not reduce errors. The successful application of multicontext intervention in enhancing strategy use could be explained by its principles, in which transfer and generalization involves differentiation of the strategy from the context in which it is learned (Toglia, 1991). Multicontext intervention was designed to facilitate this differentiation by varying intervention activities in a systematic manner and explicitly making connections between sessions. In addition, training in recognizing the need for a checklist and self-monitoring performance appeared to be a key element in effective use and transfer in the multicontext approach.

This is consistent with findings by Ownsworth, Quinn, Fleming, Kendall, and Shum (2010), who observed that self-regulation on a complex task can improve without global improvements in self-knowledge. However, it could be argued that repetitive practice of the checklist in different situations created automatic learning and habit formation of its use (Giles, 2005; Martelli, Nicholson, & Zasler, 2008). It is our view that both arguments are valid. Thus, although some aspects of the learned transfer may have involved unconscious or automatic mechanisms, active and deliberate self-monitoring mechanisms were significant contributors to this process.

The findings in this case suggest that improvements in specific self-awareness and strategy use led to better functional performance (Goverover, Johnston, Toglia, & Deluca, 2007; Ownsworth et al., 2009). General awareness or verbal acknowledgment of cognitive difficulties remained unchanged with intervention. Awareness that was tied to specific difficulties in using a list improved across intervention sessions and led to greater strategy use and improved performance on post-intervention measures. This observation is consistent with accumulating evidence that suggests metacognitive strategy instruction with TBI should be incorporated into intervention when improvement in everyday functional problems is the goal (Kennedy et al., 2008).

The gains observed in functional performance immediately following intervention were not completely maintained after 4 weeks. This trend toward baseline after 4 weeks suggests that strategy training may need to be gradually rather than abruptly withdrawn. Alternatively, strategy training should be reinforced after intervention concludes. Factors that contribute toward the maintenance of strategy use, such as length of intervention sessions, follow-up sessions, training environment, or family support, need further study. Extension of training to include caregivers and RC’s home environment is likely necessary to sustain results.

During the process of designing this study, a structured method to facilitate and rate strategy generation and specific aspects of awareness was developed. Observations across intervention sessions suggested that initial emergence of awareness
was most likely to occur when questions focused on specific symptoms or task components asked within the context of an activity experience. Differences in responses to general versus specific awareness questions have been observed by others (Sherer, Bergloff, Boake, High, & Levin, 1998). This suggests that clinicians should carefully consider how awareness questions are worded and use questions that vary in level of specificity. In addition, the questions asked were about identification of challenges or obstacles as opposed to asking about problems or difficulties. This wording created a positive and active learning experience for the participant and appeared to contribute to creating a supportive atmosphere.

Occupational therapy literature emphasizes the use of a client-centered approach in intervention (Roley et al., 2008). However, clinicians may face challenges using this approach when an individual does not have the awareness or prerequisite skills to identify realistic personal goals. This case suggests that the ability to identify goals may emerge during intervention and may be an indicator of changes in awareness. For example, the participant exhibited severe impairments in self-awareness and executive functions. Therefore, the early stages of intervention were therapist directed and activities were pre-chosen. Gradually, as awareness began to emerge and the participant anticipated and recognized difficulties within activities, she was encouraged to choose from activity lists that were provided to her. She was eventually able to identify and generate her own goals and activities. Thus, self-identification of goals may be a goal itself rather than a place where intervention begins.

When interpreting results of the current study, it is important to consider several factors that may limit its generalizability, most notably the fact that this is a case study with only one participant. This study represents an initial phase of intervention development. Phase 1 intervention trials involve adequate description of intervention components, testing of feasibility, client engagement, and characterization of intervention patterns or response to intervention (Johnston & Case-Smith, 2008). Additional research with a larger sample and randomization to experimental and control groups is needed. Despite the limitations, this case study represents the application of the multicontext intervention approach and provides an in-depth description of the intervention process.

Conclusion

Occupational therapists frequently provide clients with compensatory strategies or supports that are designed to enhance performance in specific tasks and routines (Giles, 2005; Schwartz, 1995). This case study suggests that transfer of strategies can be achieved if transfer is planned in advance and provides multiple opportunities to practice across varied activities. The clinical implications of this study, although preliminary, are that training in strategy use across functional meaningful activities and contexts should be incorporated into ordinary therapies used in rehabilitation to facilitate awareness of and adjustment to acquired cognitive limitations.

Acknowledgments

This case study was part of a larger study supported by an Extramural Research Associates Research Development Award (EARDA), Department of Health and Human Services, National Institute of Health # 2G11HD035965 awarded to the first author by the “Enhancement of Mercy College Office of Research Development.” The authors thank staff members and the participant at the Transitional Rehabilitation Center at Helen Hayes Hospital, West Haverstraw, New York. Special thanks to Ms. Renee Reichenbach, Lori Macleod, OTR, Glenn Seliger, MD, and Andrew Hornstein, MD, for their support and assistance, as well as to Mercy College Graduate OT student research assistants.

References


