

**U.S. Department of Defense/Veterans Healthcare
Administration**

**Symptom-Targeted Approach to Rehabilitation for Concussion
(DoD/VA STAR-C)**

Clinician Resource Manual

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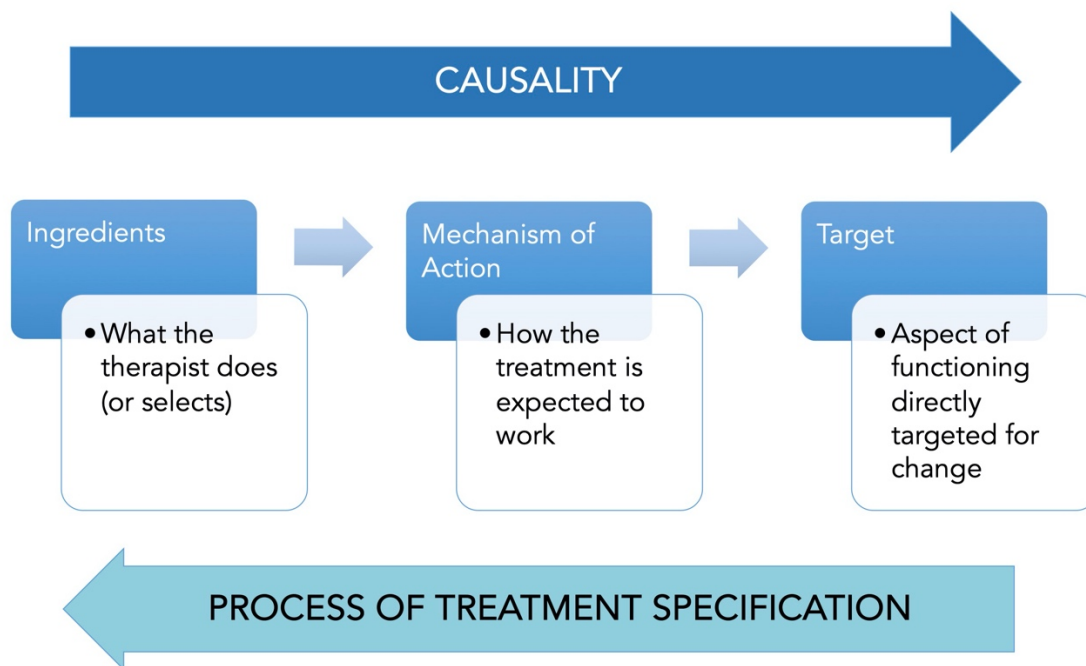
Rehabilitation Treatment Specification System Review

The Rehabilitation Treatment Specification System (RTSS) is a system for describing and classifying rehabilitation treatments. The RTSS was developed by a multidisciplinary group of rehabilitation specialists, motivated by the lack of information about rehabilitation treatment methods, not only in research studies but also in clinical practice. While there are several systems for describing patient and study characteristics (e.g., CONSORT ¹) and systems for classifying goals of treatment (e.g., the International Classification of Functioning, Disability, and Health; ICF ²), these systems describe the *who* and *what* of rehabilitation. The treatments themselves, however, often are described only in terms of duration of a particular service (e.g., hours of speech therapy), or by the problems they are intended to treat (e.g., cognitive rehabilitation). What these systems do not tell us is the *how* of rehabilitation: what the clinician does or provides to a patient in a therapy session. The RTSS is intended to organize treatments according to these clinician actions, specifically clinician actions that are known or hypothesized to account for changes in patient functioning.

The RTSS is a “top-down” approach, based on *treatment theory* ³. Treatment theories specify how changes occur, i.e., what actions by a clinician lead to changes in patient function, and by what underlying mechanisms ⁴. In the RTSS, **treatment is specified according to the clinician’s theories about actions or objects that will improve the patient’s functioning**. This is in contrast to “bottom-up” approaches like practice-based evidence, which collect data from clinical practice and seek to identify practices that improve functioning ⁵. **The RTSS is concerned only with direct interactions with patients or other treatment recipients** (e.g., family members); that is, it is concerned with what happens during a treatment session. It is not concerned with other aspects of rehabilitation that can influence patient outcome, including assessments that precede treatment (e.g., neuropsychological testing), healthcare system features (e.g., access to services), institutional practices (e.g., team meetings), or environmental features that support patient functioning in general (e.g., closed captioning or curb cuts). These aspects of rehabilitation are the province of *enablement theory* ⁴, which addresses broader context of intervention and the many factors that contribute to successful outcomes. For example, return to work might require not only treatment of specific skills, but also non-treatment factors such as transportation, employment opportunities, and family support. Thus, training of specific skills would be the province of treatment theory, but the many factors contributing to employment would be the province of enablement theory.

The RTSS has a tripartite structure: ingredients, targets, and mechanisms of action, as shown in Figure 1. **Ingredients** are what the clinician says, does, or provides, to improve patient functioning. **Targets** are the aspect of patient functioning that the clinician desires to change, and **mechanisms of action** are mechanisms by which that change occurs. A note about the word *target*: clinicians may be accustomed to using terms such as *long- and short-term objectives* or *goals*. Meaning and use of those terms varies across settings: sometimes they refer to what is expected to improve in a session or across sessions, sometimes it’s what is expected as an outcome of a rehabilitation stay or after a fixed time interval (e.g., one week), and sometimes it is what we hope for in the patient’s life after discharge. In the RTSS, we chose to use the word *target* to be clear that it is the specific aspect of patient functioning the clinician hopes to improve by *direct* interactions with patients or other treatment recipients, and that is what the clinician chooses to address within a treatment session.

Figure 1. The tripartite structure of the RTSS (ingredients, mechanisms of action, target) and process of treatment specification and causality.



Ingredients and targets are always measurable, at least in theory. By contrast, mechanisms of action often are invisible to us, particularly for treatments like cognitive rehabilitation, where the mechanism of action might be “changes in the brain”. As shown in Figure 1, clinical reasoning typically proceeds from the target to the ingredients; that is, the clinician identifies the aspect of function (target) that should be improved, and then chooses ingredients that he or she theorizes will improve that target.

Also shown in Table 1 are the three categories of targets: **organ functions (O)**, **skills and habits (S)**, and mental **representations (R)** (i.e., knowledge, beliefs, and attitudes). Examples of targets and ingredients in each category are shown in Table 1. Targets can be at any level of the ICF: personal factors (e.g., counseling for depression), environmental factors (e.g., educating family members about injury effects), body structures and functions (e.g., training attention), activities (e.g., teaching strategies for note-taking in class), or participation (e.g., providing information about a support group). The key is that clinicians theorize that what they do or provide will *directly* improve patient functioning for that target. For example, if joining a support group is the target and the clinician addresses that target by providing information, that means the clinician believes the *only* barrier to joining a support group is lack of information. If joining the support group also requires goal-management training to improve follow-through, improving conversation skills, and increased motivation and self-efficacy, then each of these may be a target for rehabilitation.

Table 1. Treatment groups in the Rehabilitation Treatment Specification System				
Name of Group	Definition	Typical Ingredients	Mechanisms of Action	Clinical Examples
<u>Organ Functions</u>	Change or replace organ functions	Energy applied to soft tissues Exercise schedules for strengthening or endurance training Devices for limb or organ replacement	Depends on the organ, e.g., tissue stretching, increased cardiac efficiency, artificial organ features	Hearing aid placement Deep brain stimulation Serial casting Passive range of motion exercises Aerobic exercise to improve cardiovascular fitness
<u>Skills & Habits</u>	Improve ability to perform a mental or physical activity	Opportunities for repeated practice Instructions Modeling Cues Feedback	Learning by doing	Training to use a strategy of deep breathing when stressed Training to use a strategy of eliminating distractions in the workplace Training to use a digital reminder system
<u>Representations</u>	Enhance knowledge, or modify attitudes or emotional responses	Didactic instruction Providing information in multiple modalities Linking to previous knowledge Prompts to evaluate task importance or self-efficacy	Cognitive or affective information processing	Patient education Strategies to increase patient motivation

We chose to use the RTSS for this study because it provides three advantages:

1. Ensuring a match between ingredients and targets.

Treatment is most efficient and effective when treatment ingredients match the target category. For example, if the target is for the patient to always turn off the television when having a conversation (an S target), the clinician should *provide opportunities for practice* (an S ingredient) vs. *explain how turning off the television can improve focused attention* (an R ingredient).

In typical cognitive rehabilitation activities, there is sometimes a mismatch between ingredients and targets. For example, in the SCORE treatment trial⁶, patients were provided with a list of strategies to “optimize attention.” There were 15 types of strategies, most of which include two or more sub-strategies. For example, the strategy “Modify times” included these sub-strategies: choosing your individual best time, such as morning or afternoon, to focus on a task requiring attention to detail; allow

yourself time when changing tasks; when changing tasks, verbalize what you are currently doing; and if you know you will be interrupted, work on a very familiar mundane task. Providing a list of strategies is an appropriate ingredient if the target is *knowledge* about strategies (an R target), but if the target is for the patient to habitually use an attention-optimizing strategy in everyday life (an S target), then the clinician must provide opportunities to practice (an S ingredient).

2. Identifying themes across treatment activities.

A theme across cognitive signs and symptoms in patients with a history of mTBI is **reduced information processing capacity**. Complaints from patients with an mTBI history include difficulty listening in noisy environments, thinking when they have pain or fatigue, focusing on one source of information in the presence of multiple stimuli, and sustaining mental effort over time. Many strategies used in cognitive rehabilitation address information management, but the strategies often have different names (e.g., time management strategies, strategies for reading information-dense text, strategies for remembering everyday tasks). By specifying targets and ingredients using the RTSS, we identify commonalities across activities, which makes targets clear to participants and helps focus intervention on an economical set of activities.

3. Adding volitional ingredients.

A feature of the RTSS that is critical for rehabilitation is the inclusion of **specific ingredients and targets related to patient engagement and motivation**. In the RTSS terminology, these are referred to as **volition** ingredients and targets, because they relate to the patient's likelihood of taking voluntary action. Volition ingredients are critical any time we expect a patient to voluntarily do a therapy task, especially when that task will be performed outside of the therapist's direct supervision, i.e., as homework.

Successful performance of any voluntary task depends on three factors: 1) the patient must be capable of doing the task, i.e., must have the skills and knowledge; 2) there must be an opportunity to do the task (e.g., if the task is to practice with a partner, the partner must be available); and 3) the patient must be motivated to complete the task⁷. When prescribing treatments, especially homework, we need to ensure that the third factor – volition – is addressed. Volition ingredients are particularly important for this intervention because it is focused on improving patients' function in their everyday lives.

The RTSS offers many benefits, including enhanced communication across disciplines and among team members, including the patient and family; improved consistency in implementation of treatments, especially evidence-based treatments from the literature; more consistent documentation and communication with third-party payers, with positive implications for billing and reimbursement; and advances in knowledge about effective treatment methods, which will strengthen the evidence for our treatments.

RTSS specification examples are provided in the Clinician Manual.

Review of Cognitive Functions

In this section, we review two groups of cognitive functions that are central to rehabilitation for individuals with cognitive impairments after TBI: 1) memory subtypes and 2) executive functions.

Memory Subtypes

Memory is traditionally categorized into *long-term* and *short-term*. These two memory types are primarily distinguished by: (a) the duration of the memory store and (b) the capacity of the memory store. Long-term memory holds information in a permanent store and is thought to have unlimited capacity. Short-term memory is what is “on your mind” at any moment in time, your “mental workspace”⁸. It is what a person can hold in conscious thought if they aren’t interrupted and thus has a short duration and a limited capacity (about seven items or chunks of information). The historical definition of short-term memory includes only the capacity for holding items. The ability to manipulate those items is *working memory (WM)*, which is likewise a limited-capacity, short-term, attention-constrained memory subtype. WM allows us to temporarily hold information in mind while applying strategies like elaboration during learning⁹, or while searching long-term memory for an idea or word we are trying to retrieve.

WM and short-term memory (simple span) are different constructs with hypothetically different neuroanatomical substrates. In clinical practice, however, WM tests typically require a combination of short-term storage of information *and* the active process of manipulating that information for storage or retrieval⁸, so we often lump span and processing capacity together as “WM capacity”. People with TBI rarely have problems with simple storage, so intervention generally focuses on the “working” part of WM.

Long-term memory encompasses a number of different types of memory distinguished by the types of information stored and how that information is learned and retrieved. The most basic distinction in long-term memory types is between *explicit or declarative* memory and *implicit or nondeclarative* memory. These two memory types are quite different:

Declarative memory constitutes a person’s knowledge base and is information we can consciously access. Two distinct categories of declarative memory are semantic and episodic memory. Semantic memory is our mental thesaurus and comprises our knowledge-base. Episodic memory comprises our memory for events, including autobiographical memory. Although these two memory subtypes represent different systems of learning, they are highly interdependent at both encoding and retrieval phases of learning. For example, existing knowledge (semantic knowledge) affects learning of new episodic memories in both healthy and impaired learners¹⁰. Declarative learning is enhanced by conscious strategies like elaboration or trial-and-error discovery methods. It is not tied to the learning context, so it can be generalized to other situations. For example, you can recall a family holiday event from your childhood without physically being in the setting in which it occurred, although that setting might provide useful cues to help retrieve memories. Retrieval of long-term declarative memory is helped by meaning cues and prompts, as well as by effortful search of long-term memory (e.g., thinking of relatives who might have been at that family event, or receiving hints from family members). Because declarative memory is conscious, it is encoded and retrieved using working memory. This is another case in which a working memory impairment can masquerade as a long-term declarative memory impairment: if the client cannot hold information in mind long enough to use a strategy, that person

might appear to have a declarative memory impairment. If the information is divided into smaller chunks or made simpler, however, or if distractions are reduced, the client might perform normally.

Nondeclarative memory includes memory for procedures (because of this, nondeclarative memory is sometimes called *procedural memory*) and also unconscious emotional associations, like when you have feelings about a person or place and can't remember why. Nondeclarative memory does not rely on conscious learning and it allows a person to learn without having conscious awareness of the learning. It is *probabilistic*: that is, what is learned is the information or skill that has the highest probability of being repeated, regardless of the importance of the stimulus. For this memory subtype, "practice makes perfect"; or, as a clinician might say, "practice makes habits". When nondeclarative memory fails, attempts to consciously retrieve it are unhelpful. For example, to remember the number of days in a month, many people have learned the "thirty days has September..." rhyme. To recall a particular month, we might have to start at the beginning of the rhyme. Hints, cues, and encouragement to "try harder" (all of which rely on declarative memory processes) are likely to be less effective.

Unlike declarative memory, nondeclarative memory is highly context dependent. You might be able to recall a childhood family event by thinking consciously about it, but you are unlikely to remember procedural information such as how you learned the social skills you used on that day or held your fork at dinner. Because of this context dependence, nondeclarative memories do not automatically generalize except to situations with highly similar surface features. This *hyperspecificity* of learning is a challenge in rehabilitation, and likely underlies much of the failure of generalization of treatment gains outside of the clinic. Strategies to promote generalization of nondeclarative learning will be discussed in subsequent chapters.

Anterograde memory loss affects the ability to remember events occurring after the onset of a memory problem. *Retrograde memory* loss refers to the inability to remember information prior to a neurological insult. *Posttraumatic amnesia* is the period of time, usually following a loss of consciousness, when declarative learning is impaired and nondeclarative learning is mostly intact. Thus, a patient in PTA is unable to consolidate or lay down new conscious memories.

Executive Functions

EFs are cognitive functions that allow us to control our thoughts, feelings, and actions. We call them "top-down" processes because, as Diamond stated in her excellent EF review ¹¹, they are needed "when you have to concentrate and pay attention, [and] when going on automatic or relying on instinct or intuition would be ill-advised, insufficient, or impossible" (p. 136). In other words, they shape our response to bottom-up stimuli that elicit reflexive actions. Figure 2, from Diamond's review, shows the three core functions that comprise EFs: **inhibition**, **WM**, and **cognitive flexibility**. Higher-order functions such as reasoning, problem-solving, planning, and organizing are built on these three core functions.

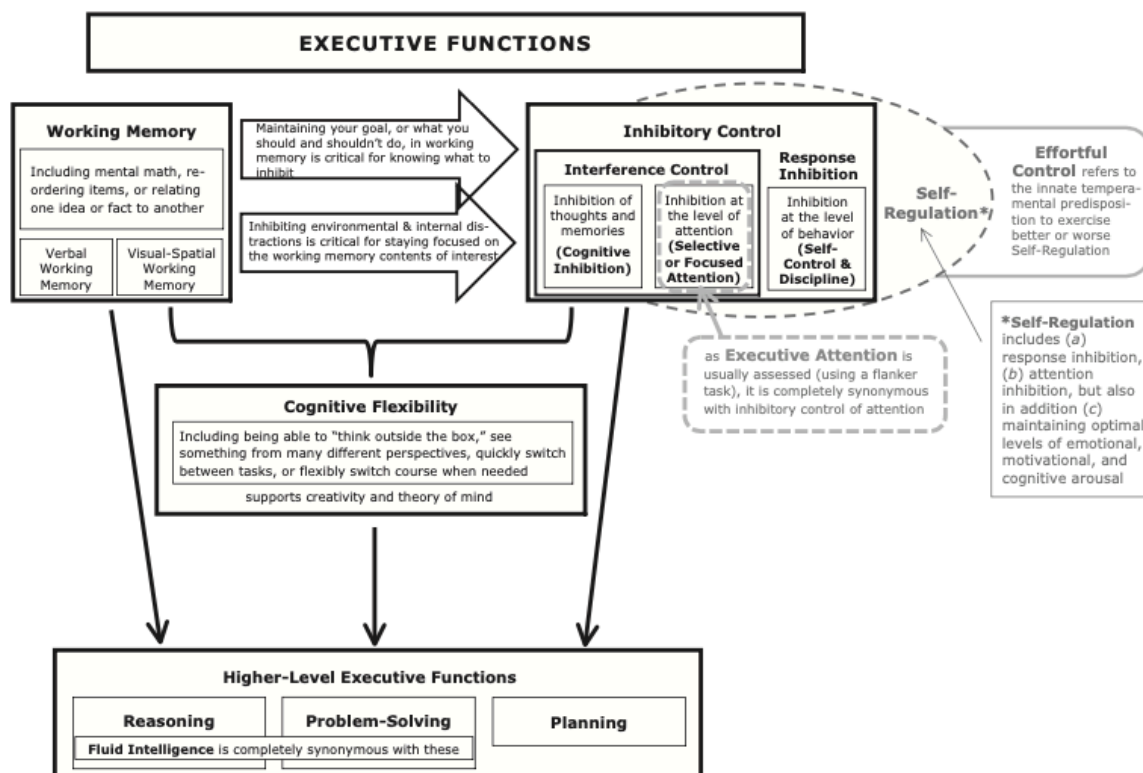
A caveat to the summary below is that there is still considerable scholarly and clinical debate about the nature of these functions and how they interact or overlap. This debate is described in detail in the Diamond ¹¹ review, and readers are encouraged to consult that source for more information.

Inhibition

Inhibition is our ability to "override a strong internal predisposition or external lure, and instead do what's more appropriate or needed" ¹¹, p. 137). It is required for *self-control*, the cognitive function that

allows us to resist temptation and delay gratification (see the [Marshmallow Test](#), which is widely studied in fields such as health psychology^{12,13}), and also underlies control of other cognitive functions, like the ability to focus on a target, resist distractions, and stay on task, in order to achieve a goal. Inhibitory control allows you to do physical tasks, like sticking to an exercise regimen or quitting smoking, and also cognitive tasks, like controlling negative thoughts or weighing all arguments before coming to a conclusion.

Figure 2. Executive functions and related terms. From Diamond¹¹.



Two aspects of inhibitory control are particularly important for TBI rehabilitation. First, delaying a response helps. This delay benefit underlies many problem-solving and self-regulation (SR) rehabilitation strategies, like the “STOP-RELAX-REFOCUS” strategy used by Novakovic-Agopian et al¹⁴ to help veterans with TBI. Second, SR resources can be depleted. SR depletion has been well studied in the social psychology and marketing fields^{15,16}. It is well known that people are less likely to persist on a task if their preceding activity depleted SR resources¹⁶ (e.g., be patient with a partner at home after being on their best Behaviour all day at work). When patients say they have “mental fatigue” or “hit a mental wall” at some point during the day, they may be talking about SR depletion. SR depletion crosses modalities and contexts¹⁶, so a cognitively demanding work environment, for example, can reduce self-control for alcohol consumption in the evening.

The good news is that SR capacity can increase with practice (at least in people without TBI¹⁷, especially children¹⁸) and SR resources are replenishable (or “repletable”). SR “repletion” activities used in experimental tasks include self-talk with affirmations (e.g., reflecting on successful performance,

positive self-talk like “I can do it!”)¹⁹. Activities that replenish SR vary from person to person, however, so it may be useful to ask that person what they do to have a “mental break” or “recharge”.

The patient’s attitude about their SR capacity also may play a role in performance. In one study, participants who believed self-regulation was limitless performed better on a sustained learning task²⁰, so it may be helpful to consider both a patient’s signs of SR-fatigue and also their beliefs about their own cognitive resources.

Working Memory

We discussed WM earlier in this section, in the context of memory subtypes. WM allows us to perform complex daily activities such as reasoning, learning, and comprehension, and thus it is often referred to as the mental workspace for EFs and their derivative, *metacognition*, the process of thinking about one’s own thinking and making adjustments accordingly.

WM has a bi-directional relationship with inhibitory control. You need WM to keep ideas in mind long enough to decide which are relevant, and to make space for ideas in WM you need to clear out extraneous thoughts. You need WM to keep goals in mind so you can stick to them, but you also need to ignore distractions long enough to achieve those goals. Improvements in one function also can improve the other, e.g., benefits of “WM therapies” may come from learning to better focus attention on a task.

It can be a challenge clinically to disentangle WM from inhibition and higher-order EFs. For example, a person with a WM impairment might not be able to hold information in mind long enough to plan, organize, or sequence it; or they might have trouble holding information in mind because they have poor inhibitory control. Likewise, what appears to be a deficit in metacognition (e.g., lack of awareness of one’s deficits) can be in part because the person is operating on old information (lack of inhibition) or can’t hold current task performance in mind long enough to evaluate it (WM).

Cognitive Flexibility

Cognitive flexibility develops in childhood after WM and inhibitory control, and builds on those functions¹¹. Cognitive flexibility includes spatial flexibility – literally imagining how something would appear from another perspective, as on the classic Piagetian Three-Mountain task, in which a child sits on one side of a mountain display and is asked to imagine what a doll would see from a variety of angles of view. Perhaps more relevant to everyday adult life, cognitive flexibility includes figurative shifts in perspective that allow you to “see” how others see things, change our thinking and actions to adapt to ongoing conditions, and generate new ways of doing things when current methods aren’t successful. Neuropsychological tests of cognitive flexibility include tests such as verbal fluency (how many words can you think of starting with the letter “F”?) and alternation tasks like the Trailmaking Test (switching between letters and numbers).

Cognitive flexibility requires inhibitory control, as we need to stop doing something to start doing something else, and working memory, the workspace in which to maintain whatever perspective we choose. Sorting out which of these EFs is the problem for a given patient can be a challenge, even with neuropsychological tests (e.g., does the patient name only F names for animals because they got stuck in the animal category, couldn’t keep the instructions in WM, or thought the examiner would approve of that strategy).

The Role of Standardized EF Tests

There has been a longstanding debate about whether standardized EF tests capture everyday EF problems ²¹, especially in patients with non-TBI reasons for EF impairments, such as comorbid mental health problems. The latter might explain the lack of congruence between objective and subjective EF measures in military personnel ²², where the prevalence of comorbid depression and anxiety is high, and the overall lack of concordance between objective data and self-reported problems in this clinical population ^{23,24}. In rehabilitation, we are treating the person who has beliefs about their own cognitive functioning; so selection of targets is based on self-reported problems.

Overview of Instructional Methods

Adapted from Sohlberg & Turkstra (2011)

We teach patients new knowledge and skills using two broad categories of instructional techniques: (a) systematic instructional methods and (b) conventional methods. Systematic instructional methods were originally developed in recognition of the need to control errors when training individuals with declarative learning impairments who learned primarily via classical conditioning. More broadly, “systematic” refers to educational approaches in which the instructional methods and sequence of learner steps are planned in advance, based on a careful analysis of learner characteristics, and build from simple to complex. Systematic instructional methods are often called “**error-control**” or “**errorless**” methods because the focus is on creating a learning situation that increases the likelihood of correct performance and decreases the likelihood of errors. By contrast, in conventional approaches the materials and methods are adapted based on the learner’s preferences or style or *in response to* the learner’s errors. “**Trial and error**” or “**test and correct**” are common conventional instructional methods in which the learner is given feedback after an error is committed. Thus, the main contrast between systematic instruction and conventional instruction is error control in the former.

Error-control research in cognitive rehabilitation began in the 1980s with studies of patients with dense anterograde amnesia²⁵⁻²⁷. These individuals demonstrated the ability to learn new information and procedures if they rehearsed them enough, but had no conscious memory of either the learning event itself and would deny that they possessed the new knowledge and skills. In this category of techniques, errors are minimized during the acquisition phase by providing a model of the correct response *before* the client attempts to produce it (referred to as *most-to-least* cues), and guessing is discouraged²⁸. This is in contrast to conventional, *least-to-most* cuing methods, in which the learner first attempts the target, then, if he or she fails, is provided with progressively more cues until he or she is able to produce the correct response. Systematic instruction was initially applied to the training of motor skills and later used to teach more complex behaviors and concepts such as metacognitive strategies.

Within the category of error-controlled instructional techniques, two specific methods are common in the ABI research literature: the method of vanishing cues (MVC) and spaced retrieval (SR) training. MVC is a form of error-controlled learning in which the client is given progressively stronger or weaker cues following recall attempts of the targeted information or skills²⁵. In the initial versions of MVC, the patient was provided with the full target, then a single-letter cue with other letters added until the patient got the correct answer, then faded. For example, if the goal is learning to associate the name “Marilyn” with a photo of a woman, the client might be told the name initially, then given the cue “Mari” and asked to complete the name. If the client made an error, additional letters would be provided one at a time until the correct answer was produced (e.g., “Maril”, “Marily”, “Marilyn”). If the client answered correctly, the next presentation would have one less letter (i.e., “Mar”). As shown by this example, the original version of MVC was not an error-free technique, as the client could give the wrong answer four times before giving the correct answer. More recent versions of MVC have error control, typically by presenting the full stimulus then fading cues rather than adding, guessing, then fading²⁹.

SR is like MVC in that errors are minimized, but the focus is to manipulate the time intervals at which recall is elicited. SR is a form of *distributed practice*; that is, successful recall of information over expanded time intervals³⁰. In SR, the client is provided with the full correct response initially and asked to first repeat it immediately, then recall it at longer time intervals without cues (i.e., expanded rehearsal). If the client makes an error, he or she is immediately provided with the correct response and

asked to repeat it, then the next recall interval is shortened to the last interval at which the client was successful. In the example above, the client would be told, “This person’s name is Marilyn. So when I say “What is her name?” you’ll say her name, you’ll say Marilyn. What is her name?” If the client responds correctly, they will be prompted again after 30 seconds. If that is correct, the recall interval will be doubled. If the client makes an error at 60 seconds, he or she will be immediately provided with the correct response, asked to repeat it, then asked again after a 30-second day (i.e., the last interval at which the client provided a correct response). SR is sometimes combined with MVC in the initial training phase if the person is unable to recall the target at the shortest time interval^{31,32}.

Appendix C is an SR training guide that was created for family members of patients with TBI. The guide was created at the request of families, who observed SR training on the in-patient service and were interested in replicating it at home. It is included here as a resource for plan-language instructions and includes tips learned from clinical experience with SR. The guide is not intended to replace the SR training manual on which it is based, and readers are encouraged to purchase the SR Training Manual: *Benigas J, Brush J. Spaced Retrieval Step by Step: An Evidence-Based Memory Intervention. Baltimore, MD: Health Professions Press; 2016.*

While both MVC and SR training have been described as errorless learning techniques, they may be described more accurately as *error-control* methods. While MVC focuses more on the method of initial target acquisition and SR training focuses on long-term retention, both instructional methods emphasize explicit, carefully faded models/prompts. This contrasts with errorful or trial-and-error methods, which emphasize attempts by the individual to recall the target information or skill without prior models or prompts, with the trainer providing models only as feedback in response to errors. To continue with our example, the clinician would first ask, “What is the name of this person?” If the client made an error, he or she might be given an explicit hint (e.g., “It starts with the letter M” or “It’s the first name of a shock-rock musician”), then ask the client to attempt recall again.

How do you know when to use error-control methods?

The Patient

Conventional memory-training methods, including strategies like visualization and elaboration require conscious effort, so they may be better suited for individuals with insight into their limitations. These techniques are initiated by the learner and thus require an understanding of when to implement the technique and a sense of how it will be helpful³³. Systematic instruction methods like SR require limited insight, although the person must be sufficiently motivated to participate in treatment. Thus, a highly motivated individual with relatively good awareness, who has a job that demands independent recall of facts, may be a better candidate for an explicit strategy like visualization. By contrast, a person with the same employment demands but limited awareness might be a better candidate for an implicit learning strategy such as SR, with the goal of training him to use external aids or highly structured procedural routines, both of which can be trained as automatic behavioral sequences without relying on significant client insight.

The Target

Error-control methods are most helpful for S and R targets that occur often enough to become a habit, as the key ingredient is providing opportunities for high-dose practice. A second, and perhaps the most critical, consideration in training is whether the target fact or concept is going to change in the future.

Facts and concepts, once learned, may be very difficult to extinguish, particularly for individuals with severe anterograde memory impairments. For example, Bourgeois and colleagues³⁴ were asked by care staff to teach a group home resident that bowling was scheduled for Wednesdays. The aim was to reduce the resident's repetitive questions about the date for bowling, which had been on Tuesdays the previous year. This resident had dense anterograde amnesia, so she learned primarily by implicit methods. The investigators used SR training to teach the new bowling day, but after three or four sessions it was proving difficult to extinguish the previous Tuesday response, and the resident was learning a response of "Tuesday...no...Wednesday", which was confusing to everyone. The care staff then told the investigators that bowling would be changing to Thursdays the next month. Clearly, the best approach in this case was to teach the strategy of checking a planner for the bowling date. That way, the routine would stay the same despite changes in the facts. One general rule of thumb is that if the facts or concepts are likely to change in the future, train a strategy or procedure to *access* the information, rather than training the information itself.

The Context

In any type of habit learning, it is important to identify the situation in which targets will need to be deployed. This includes the *physical* context, such as a classroom or office; the *person* context, such as with a family member or stranger; and the *activity* context, such as at mealtime or in response to a question from another person. The importance of context cues increases in proportion to the severity of the client's declarative memory impairment: individuals with more severe declarative memory impairments are going to rely more on non-declarative learning, which is highly context-specific. In this case, generalization to novel contexts is going to occur only to the extent that the novel context resembles the context in which the fact or concept was taught. For example, a person with profound anterograde amnesia might learn to give a brief description of his injury in response to the question, "What happened to you?" If the question changes, however, to "Tell me about your injury", the new phrasing might not serve as a cue to the trained response. Likewise, an employee learning new vocabulary words for the workplace might not automatically use those words in a variety of different ways.

Overview of Metacognitive Strategy Instruction

Adapted from Sohlberg & Turkstra (2011)

Metacognition is our ability to think about thinking. This includes knowing when and how to use a strategy that will help us understand, learn, remember, and produce context-appropriate behaviour. Metacognition has two components: being able to monitor our own thoughts, and being able to use that information to make changes that improve our thinking and behavior³⁵. For example, we may study in advance for a test (Behaviour) because we detect that we don't know the material well (self-monitoring), or meditate (Behaviour) when we feel stressed (self-monitoring). The concepts of metacognition and EFs evolved somewhat separately in the literature, both from around the 1950s³⁶.

Metacognitive ability begins to develop early in life, continues to improve into early adulthood, varies across typical adults, and is a product of both our own experiences (e.g., not studying and then failing), whether or not we were conscious of the connections at the time; and didactic instruction ("The teacher says we will do better on the test if we study in advance"). We all use metacognitive strategies. They are not *compensatory*; they are intended to be *supportive* and *adaptive*.

In cognitive rehabilitation for people with TBI, we often train people to use metacognitive strategies. We do that because TBI can affect any aspect of cognitive function, limiting the person's ability to understand, learn, remember, and produce context-appropriate Behaviour. When cognitive functions are affected, metacognitive strategies can help people with TBI successfully complete everyday tasks that they need at work, at home, in school, and in the community. The goal of cognitive rehabilitation is to rehabilitate the person not just the cognitive functions, and it might take a new strategies for that person to think and act effectively in everyday life.

It is important to remember that many people *never* consciously thought about using strategies pre-injury, or thought of them only in general terms (e.g., "reading about how to do a new task is good" vs. "I need to re-read the manual for 1 hour per day X 5 days to perform the new task successfully"). Thus, learning a strategy in rehabilitation can mean un-learning what a person has used tens of thousands of times over years of practice. As a result, patients may need a lot of practice using a strategy for it to become an automatic Behaviour. They also may need a lot of practice self-monitoring, so they know when to deploy the strategy.

Metacognitive strategies may be simple, such as teaching a person with functional attention problems to say each step in a task out loud in order to stay focused on completing the steps in order or look for controllable sources of distraction when they enter a room. They also may be complex, like using an app to track mental fatigue throughout the day. At the core of metacognitive strategy training is teaching an individual to self-regulate thoughts and actions—i.e., "think about his or her own thinking"—and to self-monitor performance during an activity³⁷. The goal is for the learner to use methods that will provide some control over his or her own learning and behavior.

There are two basic types of strategies: (1) **task-specific strategies**, such as using a reading-comprehension strategy to improve the understanding and retention of text; and (2) **general strategies** that can assist with the completion of a wide variety of target tasks, such as a "self-check-in" strategy that can be used to monitor fatigue levels throughout the day. Most research has focused on using metacognitive strategies for managing impairments in three cognitive domains: attention (e.g., sustaining and shifting attention), executive functions (e.g., initiating actions, controlling thinking), and memory (e.g., learning and remembering information, remembering to carry out intentions). As these

reflect common problems after mTBI, we will discuss strategies in these three domains. We begin with a summary of the evidence supporting use of these strategies and then identify core principles of strategy training, ending with examples of targets and ingredients for strategy training. A caveat to this discussion is that most studies focused on people with moderate or severe TBI. The general strategies typically apply to mTBI as well, and training methods and results will vary depending on patient characteristics and targets.

The Evidence

Strategies to Manage Impairments in Attention and Executive Functions

Most of the evidence related to improving everyday attention and executive functions comes from studies of Metacognitive Strategy Instruction (MSI; ³⁸. MSI uses direct instruction to teach individuals to regulate their own behavior and deliberately monitor how they are performing a target task, then change their behavior if performance is not optimal ³⁹. To self-regulate, individuals need to identify an appropriate goal and anticipate what they need to do to reach that goal, then identify possible solutions to challenges, self-monitor and evaluate progress, and modify their behavior or strategy use if they are not making adequate progress. MSI thus can be used to address difficulties with problem solving, planning, initiation, organization, and task persistence, all of which are commonly impaired in individuals with TBI and other acquired cognitive disorders. Table 8.1 lists example MSI techniques that have been evaluated in the literature and shown to produce positive clinical results.

There is substantial evidence to support the use of MSI with young to middle-aged adults with TBI when improvement in everyday functional problems is the goal, as shown by a recent evidence review and meta-analysis ³⁸. Most study participants maintained gains from therapy, but there was variability in the extent to which participants generalized strategy use beyond the targets trained in therapy. Further support for MSI can be found in the extensive literature on teaching students with learning disabilities, who often have attention and executive function impairments that resemble those seen in TBI ⁴⁰. Teaching students with learning disabilities to self-monitor thoughts and actions during academic tasks has been shown to be highly effective for improving accuracy and productivity and for promoting on-task behavior ^{41,42}.

Effective MSI approaches from the learning disabilities field include teaching students to self-monitor their level of attention or engagement, and chart or rate their perceptions of their performance. There is growing evidence to support the use of step-by-step self-regulation sequences for helping students to complete school-related goals, similar to those discussed in the adult neurogenic literature. An extensive review by Reid ⁴² demonstrated large effect sizes for teaching self-monitoring to students with learning challenges, to reduce inappropriate behavior and increase academic accuracy and productivity. Similarly, a review by Mooney et al. ⁴³ reported large effect sizes for studies that used self-management strategies for students with disabilities to increase engagement and academic productivity.

Strategies may also be used to assist with sequencing the different steps involved in a task. For example, Butler and colleagues ⁴⁴ developed a package of cognitive strategies designed to be used in “Task Preparation”, “During a Task”, and “Post Task” (see Table 8.2). The strategies were evaluated with school-age children and adolescents who had attention and executive function impairments from the effects of radiation and chemotherapy for cancer treatment ⁴⁴. As shown in Table 8.2, strategies were designed to address impairments that interfered with academic performance. The results overall were positive; however, training of these cognitive strategies was part of a larger intervention package that

also targeted affective state, motivation, and confidence, making it difficult to discern the extent to which positive effects were due to cognitive strategy instruction alone.

Strategies to Enhance Learning of New Declarative Information

A common task-specific type of strategy to support new declarative learning is an *internal* memory strategy. Internal memory strategies, commonly called *mnemonic* strategies, are techniques or methods employed by a person to enhance or improve learning and/or recall of target information. Mnemonic strategies are internal because they rely on conscious thought by the user, and are contrasted with *external* strategies like notebooks and devices that compensate for changes within the learner and attempt to lessen cognitive demands. In general, internal memory strategies require individuals to carefully attend to the information to be learned, which by itself can enhance learning. They include strategies such as elaboration, visualization, and creating mnemonics to teach facts and concepts. Independent use of internal strategies requires sufficient metacognitive ability to recognize when the strategy will be helpful (see Table 8.3 for examples of internal memory strategies and supporting research).

Internal memory strategies aim to facilitate access to stored semantic networks of information and use these networks to assist with storage and retrieval processes⁴⁵. They are useful for helping clients learn a specific body of new information – particularly for learning disparate items and coalescing them into one memory. According to Wilson⁴⁶ use of internal memory strategies can be effective because of the following:

- Strategies encourage a deeper level of processing, which improves recall
- Strategies often integrate isolated information
- Strategies often provide built-in retrieval cues

There are major caveats to using internal memory strategies, however, and not all research results are positive. Kaschel et al.⁴⁷ summarized reasons that researchers and clinician may be reticent to employ internal memory strategies, including:

- Strategies can be too complex for people with cognitive impairments
- Strategies can be unnatural and difficult to apply to everyday life activities
- Generalized use of memory strategies rarely occurs in people with cognitive impairments, particularly impairments in executive functions

The above limitations make sense for individuals with moderate to severe TBI, though it is not clear that the same is true for adults with mTBI. If they are true for a particular patient with mTBI, methods used by Kaschel and colleagues⁴⁷ may be effective: use of systematic instruction (see the S and R target error-control ingredients in the Clinician Manual), which includes high-dose spaced practice. The training included a hierarchy of exercises that gave the participants practice using the strategies and then helped them transfer the use of strategies to their everyday lives.

O’Neil-Pirozzi and colleagues⁴⁸ also conducted a controlled study evaluating the effects of teaching internal memory strategies to people with brain injury. Researchers administered a 16-week small-group memory therapy program to 54 adults with TBI who were more than one year post-injury, and compared their memory test scores to those of a group that received no training. Training methods included semantic association (e.g., categorization and clustering items according to meaning), elaboration, and visual/auditory imagery. There was a significant benefit of training, and gains were

maintained after one month with no treatment. Consistent with our earlier discussion about cognitive prerequisites for internal strategies, benefits were seen primarily in participants with mild-moderate TBI.

Strategies to Support Executive Functions

Both task-specific and general metacognitive strategies for EFs have been studied in TBI. Task-specific strategies for include approaches like recording perceived accuracy on a task to increase self-monitoring^{44,49}, and general strategies include strategies like Goal Management Training⁵⁰, a multidimensional approach designed to address a range of behaviors or processes important for completing any goal or retaining different sets of information. Both Goal Management Training and the related WSTC⁵¹ train ordered sequences of self-questioning that are designed to help with planning, organization, self-monitoring, and problem solving in everyday situations. Another general strategy approach is *personal metaphor training*, developed by Ylvisaker and Feeney⁵², in which clients learn to perform complex constellations of positive behaviors by first identifying a role model who embodies qualities they admire, and then learning to internalize those qualities and “act” like that person. The authors argued that personal metaphors might seem too abstract for persons with cognitive impairments, but in fact are a way to make complex information simple and accessible to individuals with limited metacognitive skills. In support of this, they noted that metaphors can be effective even for very young children (e.g., telling a child to act “like a big girl”), before metacognition has developed. Mindfulness training is another example of a multidimensional general strategy, and often includes sub-strategies like monitoring breathing, focusing attention, and self-talk.

This section reviewed a range of metacognitive strategies, each with its own unique characteristics. Taken together, there is substantial evidence to support the use of metacognitive strategies for people with attention, memory, and executive function impairments after TBI³⁹, particularly for individuals with mild impairments and good insight. It is not clear how strategies work at the level of the nervous system, i.e., if they are “restorative” or “compensatory”, and that distinction is both scientifically inaccurate (the brain begins to change from the moment of insult and changes continually throughout our lives) and clinically unproductive (conveys the idea that learning a strategy means “giving up” on brain changes). The most important question is whether using a strategy can help the person function successfully in important life activities, whatever is happening in the brain.

Steps in Choosing a Strategy

1. Choose a strategy that will work in the context in which it will be used.

A general principle is that strategy use will generalize to the extent that the cognitive processes and activities in the desired context are similar. There is little benefit to training a strategy that will only work in a quiet clinic environment or when cued by the clinician. Ideally, strategies should be trained in context. As training *in situ* often is impractical, ensure that training incorporates cues, stimuli, and other features of the context, so generalization is automatic.

2. Choose targets and ingredients that fit the strategy.

Metacognitive strategy training typically has three categories of targets: 1) **Representation** targets related to educating the patient about using a strategy and how it can be helpful; 2) **Skills and habits** targets for using the strategy effectively and automatically; and 3) **Representation (volition)** targets

related to home practice using the strategy. Assessment to determine the appropriate strategy also is part of the process.

3. Choose outcome measures that match targets.

The following are a few examples of S and R targets that can be easily translated into outcome measures:

- Decreased number of errors when using the strategy to perform a specified task or activity
- Increased number of accurate solutions generated when using a particular problem solving strategy
- Increased number of completed steps for multi-step tasks
- Decreased frequency of occurrence of memory failures or other problems targeted by the strategy
- Decreased self-reported stress or burden following strategy training
- Decreased perceived cognitive symptom severity when using the strategy

Consideration One: Who is the Learner?

The clinician will first consider the individual client. Assessing the client's cognitive-linguistic, physical, and sensory abilities in addition to relevant affective and social support parameters will provide critical information for selecting an appropriate strategy and planning how best to train the client to use that strategy. Generating a profile of essential client characteristics often occurs simultaneously with choosing the strategy (Consideration Two), as the client profile informs the selection of the strategy. In patients with a history of mTBI, assessment of client characteristics may be based primarily on client self-report, supplemented by standardized test results when applicable.

In terms of candidacy for strategy training, as discussed above the client must have sufficient motivation and awareness to recognize the benefits of the strategy and consider using it. Initial use of a metacognitive strategy requires an understanding of when to implement the strategy and a sense of how the strategy will be helpful. Ideally strategy use will become automatic over time with practice.

Consideration Two: Selecting the Strategy (What? Where? When?)

In conjunction with generating a client profile, the clinician will need to identify the specific strategy to be trained and delineate the subcomponents. The following three planning questions help to guide this process:

1. What is the specific need?
2. Where is the target environment?
3. When will the client implement the strategy?

The clinician will begin the planning process by *specifying the need* that the strategy will address. Selecting a best-fit strategy requires conducting a systematic needs assessment. In patients with a history of mTBI, needs often will be identified through the initial interview and in general through client self-report.

A needs assessment is the process by which *the clinician identifies factors unique to the client and environment that will determine the best strategy match for the client's needs*. Essentially, the clinician is conducting an ecological assessment, integrating relevant client characteristics (cognitive-linguistic, psychosocial, physical, and sensory) with environmental considerations, then generating possible

strategy options that will address the need and be usable by the client in his or her environment. Appendix A shows the clinical decision-making process necessary for identifying a good match. In some cases it might be necessary to conduct a dynamic assessment to determine which strategy will be most useful. For example, a clinician may assist the client in using two different strategies to complete a task, and then compare their effectiveness in helping the client achieve the target. The client will also provide input about preferences for different types of strategies (particularly if that strategy looks conspicuous in public or is something they never would have used pre-morbidly). The adoption of a strategy is more likely if a client is involved in the selection, has endorsed its utility, and perceives it to be useful.⁵³

Consideration Three: Specifying the Desired Outcomes (Why?)

An important part of the planning process is to identify the desired outcome. The clinician must be clear on: *Why am I teaching this strategy?* Expectations for learning should be specified as part of the planning process. At this juncture, the clinician will specify measurable targets and plan for evaluation.

Consideration Four: Designing the Individualized Plan

By now the clinician has gathered the information necessary to design an individualized Instructional Plan. Appendix B is a worksheet to help the clinician design a plan that incorporates information collected during the evaluation.

Implementing Systematic Instruction for Multi-Step Routines

The planning process reviewed in the above section lays the groundwork for training that will be carried out in the Implementation Phase. The planning process will have generated: (1) the identified strategy with individual steps or behaviors that comprise the strategy, (2) measurable targets to monitor performance, and (3) training stimuli to facilitate learning the strategy components. The next phase is to *implement* strategy training. The following section details the different training phases. The therapy dose needed to train a person with cognitive impairments to use strategies varies greatly depending on the client and strategy; separate training phases may not even be necessary. A review of compensatory memory strategy interventions reported a wide range of therapy doses ranging from a single hour of training to programs that required 30 treatment hours over several weeks.⁴⁵ There are no set guidelines for treatment dosage, in part because ingredients and targets are typically not specified in published studies. As the aim is for the strategy to be used automatically in everyday life, the one required ingredient in strategy training is **providing opportunities for practice**.

The following knowledge and skills are important for independent and effective strategy use and transfer to everyday life.

Knowledge:

- The client must know the goals of the strategy and the specific procedures or steps involved.
- The client must recognize tasks or environments that will benefit from strategy use.
- The client must know how strategy use will meet their needs.

Affective and Motivational States:

- The client should believe that the strategy will be useful and that learning it will be worthwhile (importance), they are ready to learn the strategy (readiness), and they are capable of implementing the strategy (self-efficacy).

- The client should be motivated to use the strategy and be engaged in the process of strategy development and training.

Skills:

- The client must have the requisite cognitive, sensory, and motor skills to make decisions about *how* and *when* to use strategy.

The sequence of steps in the training program depends on the extent to which the client meets the above prerequisites. The clinician will begin the Implementation phase by assessing the client's knowledge, affective and emotional state, and relevant skills. The strategy will have been selected in collaboration with the client. The clinician can interview the client to ascertain the depth and strength of knowledge and skills surrounding the selected strategy in order to know where to begin in therapy. The clinician can generate questions and ask the client to demonstrate knowledge using the above list as an assessment guide. Sample questions are listed below.

Sample Questions Assessing Knowledge

1. If you implement [strategy name], how do you think it will help you?
2. What are the specific steps you would follow to apply [strategy name]?
3. When do you think you would use [strategy name]?

Sample Questions Assessing Affective and Motivational States

1. Importance, self-efficacy, and readiness questions from the Clinician Manual.
2. If our therapy time is successful in teaching you to use [strategy name] in your everyday life, do you think it will be valuable? Why or why not?
3. How hard do you think it will be to do [strategy name]?
4. Do you think it will be worth it?

Skills (cognitive, physical/sensory, metacognitive)

1. Show me how you might use your strategy to do [the desired activity].
2. Show me what you would do if [a given circumstance or event] occurred? (Provide scenarios for client to demonstrate ability to use, not use, and adapt strategy appropriately.)

If the client lacks requisite knowledge and motivation, the acquisition phase of training will need to address teaching these concepts and information (see R ingredients in the Clinician manual).

Initial Acquisition Phase of Training

The purpose of therapy in this phase is to establish conceptual knowledge about how and when to use the target strategy and have the client demonstrate the basic components. For some clients, the clinician may need to teach this information as a set of concrete facts.

- The goals of this strategy are to help me _____
- I use this strategy when _____
- These are the steps of the strategy _____

A second goal of the initial acquisition phase is to ensure that the client can perform the strategy correctly in an optimal context (e.g., with maximum support and structure and no distractions). The clinician will teach the client the individual steps or components of the strategy, typically using errorless-learning and distributed-practice methods (see *Overview of Instructional Methods* in this manual).

Acquisition of the strategy often requires providing explicit cues to prompt steps or components. The clinician will begin by modeling strategy use, then may introduce one of the following learning supports as the strategy is being practiced:

- Checklist of the strategy steps
- Written cue cards prompting strategy steps
- Environmental cue (e.g., alarm) to initiate strategy
- Client states each step or a keyword representing that step as it is implemented

Ideally, the client will internalize the steps of the strategy and these supports will be withdrawn during the mastery phase, although some clients may benefit from or require an ongoing reference such as a checklist or an auditory prompt. The clinician will demonstrate the different components of the strategy and then have the client implement the strategy. With practice, the client should be able to retain the target strategy steps over increasing time intervals. This may be achieved through the use of distributed practice. Once the client meets the target of independently demonstrating strategy use in clinic, training will move to the generalization phase. There may be instances when the strategy can be trained directly in the desired context from the beginning, as when a client is using a smart-phone strategy that is portable to different environments, but **do not assume the client will spontaneously use the strategy outside of clinic without transfer training.**

Mastery & Generalization Phase of Training

The mastery phase occurs when knowledge about the strategy purpose and procedures has been acquired but strategy implementation is not consistent and has not generalized to the natural environment. Failure to generalize treatment gains to everyday life is the hallmark of EF impairments, so patients will require specific attention to generalization as a part of their training process.

The goal of the mastery and generalization phase of training is to increase the fluency and automaticity with which the client implements the strategy in everyday life. Fluency and automaticity are supported by attending to three aspects of training:

1. *Fading Learning Supports:* This refers to the progressive withdrawal of supports such as clinician prompts and cues, and also internalization of the strategies. For example, if the client is saying each step aloud as it is completed, this will be faded to inner speech (“say it in your head”). Similarly, the client may go from physically checking off each step on a checklist to using the list as a written reference when needed. It is critical to remember that some patients will *always* depend on external cues and prompts to use their strategies, particularly patients who have severe memory or executive function impairments and those who need to use the strategy in an unpredictable context. If an external cue or prompt is effective, efficient, and preferred by the client, there is no *a priori* reason to remove it.
2. *Incorporating or increasing stimulus variability.* For most clients, generalization or transfer of learning will need to be planned and trained explicitly. A main goal of this stage is to identify triggers that will facilitate the *initiation of strategy use* in the *target context*. These will have been identified in the planning process and then incorporated during this phase of training. Examples of generalization training methods include:
 - Varying training stimuli so the strategy can be triggered by a variety of environmental cues
 - Involving people in the natural environment who will serve as “cues” in everyday life

- Training strategy use in the target everyday context
 - Outlining a home program for practicing strategy use, in collaboration with client and home supports
 - Providing the client with everyday reminders to implement the strategy between therapy session, using cues such as voicemail, text messages, or email
3. *Increasing engagement.* It may be difficult for the client to maintain motivation and interest in using the strategy beyond the clinic, particularly if it is difficult to use. While this was addressed earlier in training by collaborating with the client in strategy selection, it also is important to consider strategies to maintain client motivation and engagement after discharge. Note that in the RTSS, the only target for out-of-session practice is to increase the likelihood that the patient will perform an action, not performance of that action itself, as the latter is beyond the clinician's control. Methods to increase motivation for implementing strategy are listed in the R ingredients tables in the Clinician Manual. Other suggestions include:
- Creating a customized log to help client and/or support people record strategy use and impact, to provide a concrete record of improved functioning with strategy use.
 - Asking questions that encourage the client to explore situations when the strategy would have been useful even if the client was not able to implement it.
 - Collaborating with the client to identify potential benefits and barriers to strategy use in daily living, and developing alternative plans.
 - Developing record sheet showing benefit of strategy use (e.g., time saved, number or type of goals completed, improvements in task accuracy, duration of time devoted to target task).

Maintenance Phase

The maintenance phase refers to therapy methods that increase the likelihood that a rehabilitation target will be retained after therapy ends. The clinician will want to actively plan how to avoid abandonment of strategy use once therapeutic support is no longer available. For a strategy to be maintained, it must become automatic and internalized, which begins with high-frequency practice. The primary methods to promote ongoing implementation of a strategy are the *incorporation of natural supports* and *cumulative review*. The techniques listed above for increasing metacognitive engagement facilitate the involvement of natural supports and provide a mechanism for checking in on strategy use. The use of diaries, logs and “check-ins” can be very helpful for maintaining strategy use particularly during the phase when therapy supports are withdrawn.

In terms of long-term strategy use, it is important to acknowledge that contexts and situations change; mechanisms need to be in place for re-evaluating strategy effectiveness. Depending on service delivery options and complexity of the strategy, the client may need follow-up visits or phone support to maintain strategy use over time.

Example Metacognitive Strategies from Sohlberg & Turkstra (2011)

(see tables on following pages)

Table 8.1.
Description of Metacognitive Strategies

METACOGNITIVE STRATEGY	DESCRIPTION	SUPPORTING RESEARCH EVIDENCE
Problem Solving Therapy (PST)	<i>Problem solving process:</i> participants taught steps for sequences such as: “Problem Identification & Analysis”; “Generation of Hypotheses & Decision Making; “Evaluation of a Solution”.	von Cramon et al. (1991,*1994)
Time Pressure Management (TPM)	<i>Problem solving process:</i> participants helped with increasing self awareness and acceptance of disability and then taught step by step problem solving approach rehearsed under increasing distractions.	Fasotti et al. (2000)*
Problem Solving with Impulse Control	<i>Problem solving process:</i> participants taught to document impulsive reactions to problem situations and identify strategies to avoid reactions.	Rath et al. (2003)*
Verbal Mediation	<i>Self instruction process for problem solving and goal completion:</i> participants taught to verbalize steps of multistep tasks and fade talking to whispering and then inner speech.	Cicerone & Wood (1987) Cicerone & Giacino (1992)
Goal Attainment	<i>Goal setting process:</i> participants taught steps to set goals and actively monitor progress towards goals.	Webb & Gluecauf (1994)
Goal Management Training (GMT)	<i>Goal completion process:</i> participants taught five steps-stop, define main task, list steps, learn steps, execute task, check results.	Levine et al. (2000)*
Self Monitoring	<i>Self monitoring process:</i> participants taught to make predictions and monitor performance: participants taught to anticipate their own performance and/or record task progress.	Cicerone & Giacino (1992) Suzman et al. (1997)
Self Monitoring (WSTC)	<i>Self monitoring process:</i> participant taught self monitoring steps associated with acronym WSTC: <u>W</u> hat am I suppose to be doing?; <u>S</u> elect a strategy; <u>T</u> ry the strategy; & <u>C</u> heck the strategy.	Lawson & Rice (1989)

Note: *Indicates research provided a high level of supporting evidence using a randomized controlled trial.

Table 8.2.

Sample of metacognitive strategies used at different times during a task for students with attention and executive function impairments (*Butler, Copeland et al.)

TASK PREPARATION STRATEGIES	DURING TASK STRATEGIES	POST TASK STRATEGIES
“Magic” Words” selected to increase confidence or assist with affective state	“Talk to myself” verbal mediation	“Check my work” increase self monitoring
Soup Breath relaxation technique	“Mark My Place” assist with sustained attention	“Ask for Feedback” increase self monitoring
“Game Face” approach task with confidence and minimize distraction	“Start at Top” or ”Row by Row” assist with organization and attention	“Reward Myself” increase engagement
“World Record” increase engagement	“Time out” pacing strategy	
“Warm Up My Brain” increase readiness	“Look at Floor” increase focus during public speaking or reading tasks	
	“Ask for a Hint” solicit support	

Table 8.3.
Description of Memory Strategies

MEMORY STRATEGY	DESCRIPTION	SUPPORTING RESEARCH
Visual Imagery: Structured Imagery Training	Three staged training process involving acquisition of imagery technique using hierarchical exercises and specific generalization and transfer training.	*Kaschel et al (2002)
Visual Imagery: Method of Loci	Known series of locations is memorized and person creates a visual image of information to be remembered in each location.	West, 1995
Verbal Elaboration: First letter mnemonics and rhymes	Person generates saying or rhymes to help them remember target information.	Wilson, 1995
Verbal Elaboration: Elaborative Encoding	Transforming the information held in short term memory in ways to facilitate storage in long term memory by creating association with other semantically or acoustically related information.	Oberg & Turkstra, 1998
Visual Imagery & Verbal Elaboration: Story Method	Creating a story and generating visual images incorporating information to be remembered.	Wilson, 1995
Retrieval techniques: Mental Retracing	Individuals systematically reviews previous actions in an attempt to trigger target information.	Wilson, 1991
Retrieval techniques: Alphabetic Searching	Individual systematically goes through the alphabet in an attempt to get a phonetic trigger of target information.	Wilson, 1991

Table 8.4.

Description of Task Specific Strategies

TASK SPECIFIC STRATEGY	DESCRIPTION	SUPPORTING RESEARCH
Reading comprehension strategy: Reciprocal Teaching PQRST (Preview, Question, Review, State, Test) SQ3R (Survey, Question, Read, Recite & Review)	Techniques to increase contextual understanding, encoding, and reviewing.	Rosenshine & Meister, 1994 Wilson, 1987 West et al., 1992
Writing strategy: Graphic organizer to structure content	Use of graphic organizer with flow charts to guide writer to indicate topic sentences and supporting details.	[Ylvisaker
Study Agenda	Time ordered agenda with instructions for listing homework goals and anticipating completion time.	Sohlberg & Mateer, 2000
Traveling to novel places	Destination arrival protocol for identifying: handicapped parking and ramps, restroom, seating to rest, and “helper” person.	Case examples from author’s clinic
Image-Name Match	Sequence for remembering names.	McCarty (1980)

Table 8.5.
Examples of Strategy Measurement

TYPE OF DATA	EXAMPLES	PURPOSE
SESSION DATA	<ul style="list-style-type: none"> ▪ Number of strategy steps demonstrated in clinic with no prompting ▪ Longest time interval client retained and demonstrated the entire strategy ▪ Ability to independently list and describe each step in the strategy ▪ Ability to independently state purpose and benefit of strategy ▪ Number of possible applications client able to generate for using strategy during her week 	Measures knowledge and ability to carryout strategy. Guides decisions about progress toward short term objectives and indicate when to move on or provide more review.
GENERALIZATION PROBES	<ul style="list-style-type: none"> ▪ Number of entries on strategy diary ▪ Number of teacher observations of independent strategy use ▪ Number of strategy checklists completed during the week ▪ Spouse ratings on strategy log ▪ Number of times lost place during reading session ▪ Number of reminders to return to task 	Measures use of strategy in intended context
MAINTENANCE PROBES	<ul style="list-style-type: none"> ▪ Number of times strategy used weekly according to entries on the strategy log for the initial two months following cessation of treatment ▪ Number of strategy checklists turned in to teacher during weeks 2 and 3 after therapy 	Measures implementation of strategy over time
IMPACT DATA	<ul style="list-style-type: none"> ▪ Grades on weekly history quizzes ▪ Number of items on “to do” list completed independently ▪ Ability to greet church group members by name as reported by spouse ▪ Caregiver burden rating for spouse reminders ▪ Improvements on the <i>Inattention Rating Scale</i> 	Measures whether implementation of strategy of strategy is meeting identified need
EFFICACY DATA	<ul style="list-style-type: none"> ▪ Changes on the <u>Behavioral Assessment of Dysexecutive Syndrome</u> ▪ Improvements on the <i>Paragraph Recall</i> subtest; stable performance on the <i>Design Fluency</i> subtest (control data) 	Primarily measures changes indicates processing

Example Individualized Metacognitive Strategies
SOURCE: Lee et al. ⁵⁴ study of APT-3 in six adults with aphasia.

Participant 1

- Prepare environment
- Re-engage in middle of task
- Deep breath

Participant 2

- Re-engage in middle of task
- Repetition
- Positive self-talk: “Confidence!”

Participant 3

- Prepare self and environment: “Focus, Focus, Focus!”
- Repetition
- Task engagement throughout: “Stay in the game”

Participant 4

- Re-engage in middle of task
- Verbal mediation
- Repetition

Participant 5

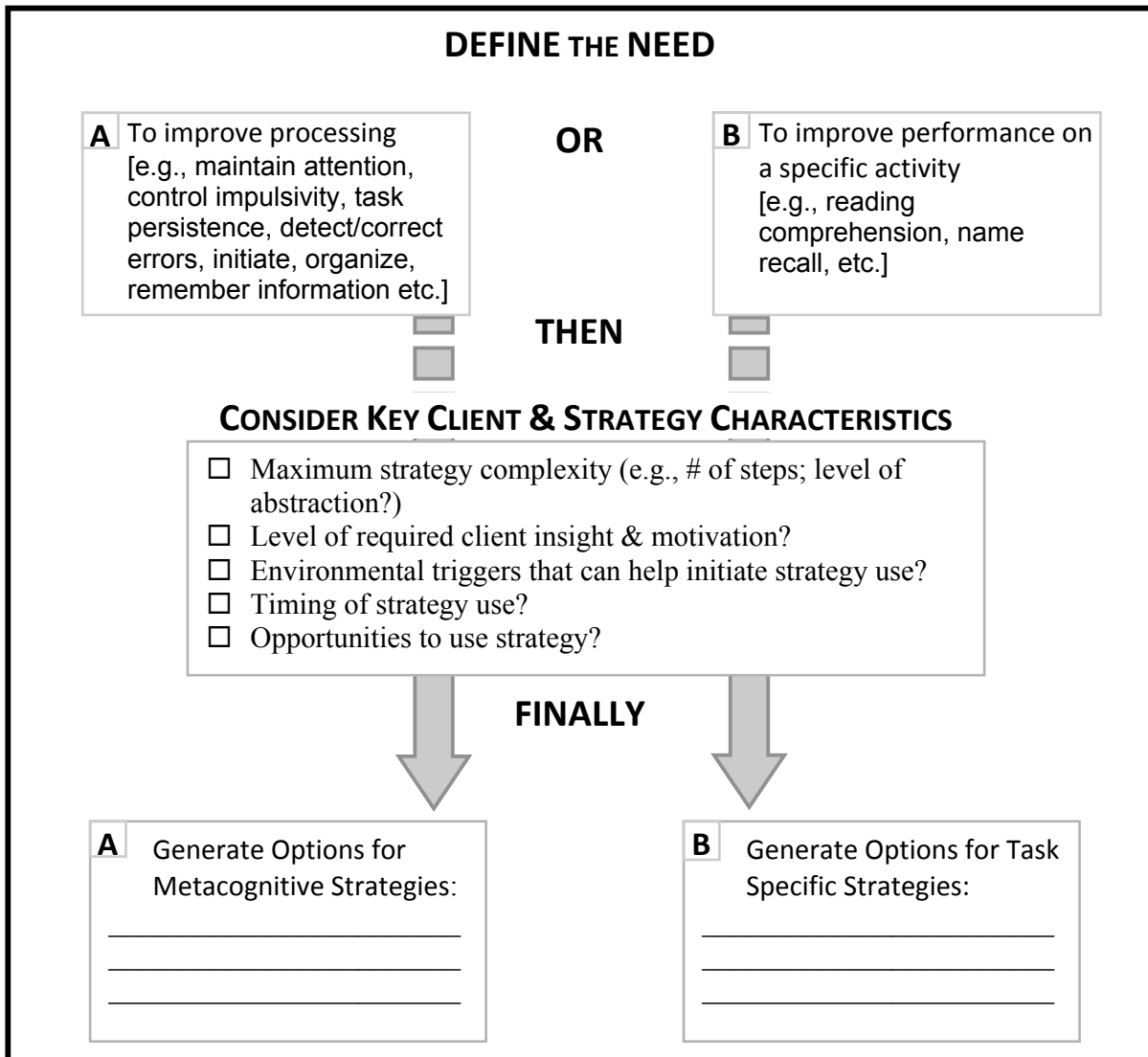
- Clarify instructions before beginning task
- Focus
- Positive self-talk: “Yes I can!”

Participant 6

- Anticipate what’s coming next
- Deep breath
- Repetition
- Stay engaged despite mistakes: “Let it go”

Appendix A. Strategy Matching Worksheet
(Sohlberg & Turkstra, 2011)

Figure 8.1: Matching Strategy, Need and Client



Appendix B. Worksheet for Strategy Instruction
(Sohlberg & Turkstra, 2011)

Target: _____

Context in which strategy will be used: _____

Factors to consider in strategy selection and how they will be addressed:

Patient cognitive strengths	
Patient cognitive limitations	
Maximum strategy complexity (e.g., number of steps, level of abstraction)	
Level of required patient insight and motivation	
When and how strategy must be used	
Opportunities to use strategies	
Environmental triggers to using strategy	
Environmental barriers to using strategy	

What will I teach the patient to do? (List steps)

What is my plan for progressing use of the strategy? _____

Strategy Checklist

- ☐ Strategy addresses identified needs
- ☐ Patient has sufficient insight/awareness
- ☐ Strategy is customized to the patient
- ☐ Context and antecedent for strategy use are specified
Session plan includes ingredients to maximize patient motivation/engagement/adherence
- ☐ There is sufficient time to practice during the session
- ☐ Homework plan includes an R target to maximize likelihood of patient completing homework

WHAT IS 'SPACED RETRIEVAL'?

Spaced Retrieval is a method used to teach new information and skills to people with memory problems. The goal of spaced retrieval is for the person to remember and recall information over long amounts of time (months, years, etc.).

WHAT DO YOU NEED TO KNOW ABOUT MEMORY TO USE SPACED RETRIEVAL?

The most important thing to know is that there are two main types of long-term memory: declarative memory (also known as explicit) memory, and non-declarative memory (also known as implicit) memory:

DECLARATIVE MEMORY. This is the kind of memory we commonly think of when we think of memory. It is the conscious recall of facts and events in our lives. It is also our ability to remember peoples' names, names of objects, and facts and concepts (e.g., that the world is round and the sun sets in the west). Declarative memory is often impaired in persons who have had an acquired brain injury such as traumatic brain injury or stroke, and in persons who have dementia. This is why they may ask questions over and over: the answer they were given could not be stored for them to remember it later.

NON-DECLARATIVE MEMORY. This is the kind of memory we use to learn habits and skills, so that they become automatic – like saying the alphabet or riding a bike. It's called "implicit" because we pick it up unconsciously. For example, you might remember the day you learned to ride a bike (the event), but you probably don't remember the muscles you used and how you put your feet on the pedals (the skill). You also probably don't remember when you learned social skills like saying "Hi" or "Bye" (the habit), although you might know you were taught in school that it's important to be respectful when talking to your elders (the concept). Non-declarative memory is almost never impaired in people with brain injury, stroke, or dementia: therefore, we can use it to help the person learn new information and skills, even if they don't remember the learning event. ***The most important thing to remember about non-declarative memory is that you learn what you practice the most, whether it's right or wrong.***

HOW DOES SPACED RETRIEVAL TRAINING WORK?

STEP 1: Identify the information, habit, or skill you want the person to remember and how they will be cued to remember. For example, "When you log into your phone" (the cue) "check your schedule in the calendar app" (their response). In this case, the person will actually log in to their phone and check the app on each trial. Your job will be to ask (cue) them to log in to their phone.

STEP 2: Practice that cue-response pair over longer and longer time intervals: first, demonstrate the cue and response and have the person repeat it immediately, then give the cue and ask them for the response. If the person gives the correct response immediately, wait 30 seconds and ask again. If they give the correct response after 30 seconds, wait 1 minute and give the cue again. Every time they give the correct response to the cue, double the time interval before giving the cue again.

STEP 3: If the person gives the wrong response, or even if they start to struggle to remember it (i.e., they try to remember it *consciously*), stop them immediately! Show them the correct cue-response pair, immediately give the cue and have them produce the response, then drop back to the last time interval that they were successful at recalling the information.

Let's take another example: learning the name of a caregiver, by linking that person's face and their name in memory. The cue is a photograph of the caregiver, and the response is the caregiver's

name. You show the photo and say the name, then show the photo again and ask the person the name. The person is able to give the correct name immediately, so wait 30 seconds and show the photo again. The person gives the correct name after that 30-seconds delay, so you double the time and ask them again at 1 minute, then 2 minutes and 4 minutes, and they give the correct answer each time. After 8 minutes when you show them the photograph again, though, they give the wrong name. You tell them the correct name while showing the photograph and have them repeat the name right away, then you present the photo again after 4 minutes (the last successful recall interval). When they are successful at 4 minutes, you then increase to 8 minutes and so on. If they miss the name at 4 minutes, you go back to 2 minutes.

STEP 4: There is no “hard and fast” rule about the length of time at which to stop, but we generally stop if the person has remembered the information, habit, or skill after a 16-minute interval.

STEP 5: At the end of every session, add up the number of errors and correct responses. If the number of errors is higher than the number of correct responses, this cue-response pair is not the best fit for that person and needs to be changed. For example, if the person wants to remember to take their pills at 10:00, and is not learning that time, it might be better to train them to use a schedule where their medication times and other events are displayed.

Correctly remembering things is very rewarding to most people, especially if they are aware of their memory problems. Keep in mind that the person might never remember these training sessions – that’s declarative memory – but still can learn and remember the information, habits, and skills they learned. It will just “pop” into their minds when the cue is presented.

HOW DO YOU KNOW WHEN THE PERSON HAS “CONSOLIDATED” THE MEMORY?

- Our general rule is to present the cue to the person first thing the next day, and if they give the correct answer then and one two days after that (i.e., three days in a row), we consider the goal “learned”.

HELPFUL TIPS

- The key to this type of learning is that **it is very specific – the person will learn exactly what you teach them.** If the information or skill needs to be used in different settings or with different people, it should be practiced in those contexts. People with milder memory problems may be able to carry over their learning to new situations, but people with more severe memory problems may need to learn anew for each situation. For this reason, choosing the cue and response is the most important aspect of Spaced Retrieval training.
- Like any technique, if this technique upsets the person, do not use it. Spaced Retrieval is designed to be rewarding. If the person does not want help, it will not be useful.
- Always teach information that the person wants to learn or that is important in their environment. Work together with the person to choose what they want to learn: the response must be natural to the person or they will not use it in everyday life.
- Teach one piece of information at a time and teach concrete information - not abstract ideas.

- Do spaced retrieval in sessions of 30-45 minutes. You can do this 1-2 times/day.
- The number of training sessions you will need to teach the information will vary depending on the person's memory impairment. There is no set number. Many people can remember the information after only 3-4 sessions, but some people may require several days of training.
- Always be consistent with what is accepted as a correct response.
- Training should have as few errors as possible. When the person does make a mistake, provide the correct information in a positive manner and quickly give the person an opportunity for successful recall by asking for the information again. People with memory loss are frequently not able to recognize errors and make corrections on their own. If the person is not immediately corrected, over time they may learn incorrect information.
- If the person is having difficulty recalling the information correctly, use the following suggestions:
 1. Ask the person to write the information that they need to learn.
 2. Provide the written information on an index card when asking for recall, to make learning errorless.
 3. Pair a motor movement (such as turning over an index card) with the correct verbal response.
 4. Gradually take away the written information as the person becomes more comfortable and successful at recalling the correct information.
- If the person is having difficulty successfully getting past a certain amount of time (for example, they can recall at 4 minutes but fail recall at 8 min, you correct them, have them repeat it, they recall again at 4 min but fail recall again at 8 minutes, and this happens again), consider the following suggestions:
 1. Provide an opportunity for the person to over-learn the information by repeatedly using the interval at which they were successful (e.g., if the person was successful after 4 min but missed three times after 8 min, have the person recall multiple times at 4 min).
 2. Gradually increase the time intervals instead of doubling them. So instead of moving from 4 min (last successful recall) to 8 min, do 5 minutes, 6 minutes, 7 minutes, and then 8 minutes.
- Be sure to write the cue and responses down. That way, you will be able to track progress and make sure the person is giving more correct responses than errors in each session. We have included a data sheet for you to use.

Information in this handout is from: *A Therapy Technique for Improving Memory: Spaced Retrieval*, by Jennifer A. Brush MA., CCC-SLP and Cameron J. Camp, Ph.D. (1998), published by Myers Research Institute Menorah Park Center for Senior Living in Beachwood, Ohio.

A newer version of this manual is available on Amazon.com:

Benigas J, Brush J. *Spaced Retrieval Step by Step: An Evidence-Based Memory Intervention*. Baltimore, MD: Health Professions Press; 2016.

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