Instructional Techniques in Cognitive Rehabilitation: A Preliminary Report

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ABSTRACT

Instruction is an essential component of effective cognitive rehabilitation, which requires teaching or reteaching a variety of skills and concepts to people with compromised learning. Currently, the field lacks a cohesive set of principles to guide clinicians' instructional behaviors. A review of the literature in related fields, in conjunction with findings in neuropsychology, reveals evidence-based principles that lead to effective instructional design and implementation. This article summarizes this work and attempts to provide clinicians with principles to guide their treatment planning when training or teaching clients with cognitive-communication disorders.

KEYWORDS: Acquired brain injury, memory rehabilitation, direct instruction, strategy training, errorless learning, distributed practice, spaced retrieval

Learning Outcomes: Upon completion of this article, the reader will be able to (1) describe two instructional techniques associated with direct instruction, (2) describe two instructional techniques associated with strategy instruction, (3) define errorless learning, and (4) describe two conditions that facilitate errorless learning.

Instruction is central to a variety of cognitive intervention approaches, including compensatory and restorative techniques.[1–3] Clinicians are charged with teaching concepts, skills, and activities to people with compromised cognition, yet most rehabilitation professionals receive little background on instructional theory or design. Training rehabilitation therapists to use specific instructional techniques has been associated with improved outcomes for patients.[4,5] In an era of reduced funding for cognitive rehabilitation, well-designed and delivered instruction may be the key to achieving enduring positive outcomes, thus maximizing the limited treatment resources available.[2,3]

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Given the critical role of instruction, one is compelled to ask: What is the best approach when teaching individuals with moderate or severe cognitive impairments to learn new information or skills? This article addresses this key question in two ways. First, it provides an overview of the research evidence supporting specific instructional principles and techniques for individuals with cognitive impairments. The overview focuses on research from the fields of special education and neuropsychological rehabilitation, which served as a rich source of relevant data on instructional techniques. Instructional techniques across a broad range of populations, including but not limited to individuals with traumatic brain injury (TBI), are reviewed. Second, we offer a schema for the application of instructional principles in cognitive rehabilitation.

The information provided in this article is based on a preliminary review of the instructional literature initiated as part of the process of generating evidence-based practice recommendations for instruction for individuals with cognitive-communication disorders after TBI. As with other work described in this issue, it was sponsored by the Academy of Neurologic Communication Disorders and Sciences (ANCDS).

LITERATURE REVIEW

Literature from the fields of special education and neuropsychological rehabilitation was reviewed to identify instructional practices supported by research evidence. Studies in these areas have measured instructional outcomes in a variety of learners, including individuals with developmental disabilities, mental health disorders, and progressive neurogenic illnesses, as well as individuals with acquired brain injury (ABI).

A cross-disciplinary literature review allows the study of populations with symptoms that are functionally equivalent to those of individuals with ABI. The same treatment approaches may be effective across these populations. For example, adolescents with attention deficit hyperactivity disorder (ADHD) resemble adolescents with frontal lobe injury in that both groups have executive function impairments (e.g., inability to shift focus) and can benefit from everyday routine-based interventions.[6] Similarly, individuals with severe memory impairments related to schizophrenia or dementia have been shown to benefit from errorless learning, as have individuals with memory impairments related to ABI such as trauma or stroke.[7–11]

Evidence from Special Education

The field of special education possesses an abundant literature evaluating instructional techniques that are highly relevant to teaching individuals with ABI. The instructional model that has been subjected to the most experimental scrutiny is *direct instruction* (DI), pioneered by Engelmann and Carnine.[12] DI is a comprehensive, explicit, instructional method shown to be effective in teaching a wide range of materials (e.g., reading, mathematics, social skills) across different populations, particularly individuals with learning disabilities.[12,13] DI requires the systematic design and delivery of instruction to facilitate efficient skill acquisition and generalization. Table 1 lists the key components and activities associated with the DI design-delivery process, using memory book training as an example. Several of these components and activities are described in the following sections.

Early work in DI established the efficacy of systematic, explicit instruction with individuals who were at risk for academic failure. Project Follow Through was a seminal, nationwide, longitudinal study comparing DI with other instructional models (e.g., self-paced learning models; developmental models) with economically disadvantaged children. DI was the only model to demonstrate positive outcomes on measures of academic skills, cognitive-conceptual skills, and affective processing.[14–16]

Glang and colleagues[17] conducted one of the first studies evaluating DI techniques for treating students with compromised learning resulting from ABI. Treatment targets included reasoning skills, mathematics facts, story problems, reading skills, and a self-management strategy. The DI training procedures were customized to each student depending on his or her particular neuropsychological profile and

Table 1 Summary of Direct Instruction Components and Activities[12–15]

Direct Instruction Components and Activities	
Design of instruction	• Analyze content to identify ''big ideas,'' concepts, rules, and generalizable strategies. • Determine specific skills, including prerequisite skills. • Sequence skills from simple to more complex. • Develop task analyses (i.e., break skills and tasks down into small steps). • Develop and sequence a broad range of training examples to facilitate generalization. • Develop simple, consistent instructional wording and scripts to reduce confusion and focus learner on relevant content.
Delivery of instruction	• Clearly state learning objectives. • Establish high mastery criteria. • Provide models and carefully fade prompts and cues to facilitate errorless acquisition. • ''Pre-correct'' by instructing prerequisite skills first or isolating difficult steps for instruction. • Provide consistent feedback (e.g., immediately model the correct response after the client makes a mistake). • Provide high amounts of correct, massed practice followed by distributed practice. • Provide sufficient, cumulative review (i.e., integrate new with old material). • Individualize instruction, including instructional pacing. • Conduct ongoing assessment to gauge skill retention.

behavioral and academic needs. The multiple baseline and case study research methodologies that were used to evaluate the effects of DI provided experimental support for using this method for individuals with ABI.

Strategy-based instruction is another instructional model that has been evaluated experimentally.[18–20] This model emphasizes teaching learners to monitor their own thinking, and it may be integrated with the previously described DI approach. Different terms are sometimes used to describe strategy-based instruction, including "procedural facilitators," "scaffolded" instruction, or "cognitive" or "metacognitive" strategies.[13,18,21–23] Core instructional techniques may include the use of advanced organizers, teacher questions and prompts to encourage student self-assessment, summarizing and elaborating content, and simple outlines of important themes and structures.[21,24]

In a study by Hughes et al,[25] nine middle-school students were trained to learn a homework completion strategy using DI techniques, including strategy-based instruction. Training was delivered four times per week for about 30 minutes per session. A multiple baseline design was used to investigate the effects of the training. Eight of the nine students significantly improved in their ability to complete homework assignments in their general education classes, as measured by simulation and generalization skills checklists, assignment completion rates, changes in grade point average, teacher ratings, and student interviews.

Several meta-analyses* have attempted to parse out the most effective instructional practices and components within the special education literature.[24,26a–31] Swanson and colleagues[24,28,30] conducted one of the first meta-analyses examining the outcomes of special education instructional practices that were used to teach a range of academic subjects to children and adults with learning disabilities.

**Meta-analysis is a process by which quantitative research findings on a prescribed topic are aggregated and statistically analyzed to determine the magnitude of difference or "effect size" between experimental and control groups (Gall, Borg, and Gall, 1996[26b]).*

From over 900 database articles in the literature, 180 studies were selected that met specified inclusion criteria (e.g., use of a comparison or control group, sufficient data to calculate effect sizes). These studies were categorized into one of four groups based on the instructional techniques used. The four instructional groups are as follows:

Group 1—Direct Instruction: This group included instructional approaches that were systematic in defining discrete instructional targets and methods for presenting and reinforcing information. Specific techniques included breaking down the instructions and tasks into small steps, teacher modeling of a skill or task, administering feedback repeatedly, providing instruction or materials at a rapid pace, distributed practice and review using probes, providing a pictorial or diagram presentation, allowing independent practice and individually paced instruction, and individual and small group instruction.

Group 2—Strategy Instruction: These were instructional approaches that facilitated learner engagement. Specific techniques included the following: systematic explanations, elaborations, or plans to direct task performance; verbal modeling, questioning, and demonstration by teachers; reminders to use strategies or procedures; step-by-step prompts or multiprocess instructions; teacher-student dialog; and having the teacher provide only necessary assistance.

Group 3—Combined Model: In this group, instructional techniques from the DI and strategy instruction models were used in concert.

Group 4—Nondirect Instruction/Nonstrategy Instruction: These studies did not adhere to a structured or systematic instructional model. They did not specify methods to identify instructional targets or deliver the material and were described as "reinforcement-only," "modeling-only," or "social skills training."

The results of the meta-analysis indicated that the combined model produced the largest effect size, followed by strategy instruction alone, DI alone, then nondirect or nonstrategy instruction. In addition to comparing the learner outcomes associated with these four instructional approaches, Swanson and colleagues[24,28,30] conducted a factor analysis to identify a core group of efficacious or effective instructional components or "practices." These were as follows:

1. *Explicit practice*: distributed review and practice, repeated practice, sequenced reviews, daily feedback, and weekly reviews.
2. *Orientation to task/advanced organizers*: statement of instructional objectives, reviewing material prior to instruction, direction to focus on particular information, providing prior information about the task.
3. *Teacher presentation of new material*: use of developed diagrams or picture presentations, new curriculum implemented, or new information from previous lesson presented.
4. *Teacher modeling of steps*.
5. *Sequencing*: breaking down the task, or sequencing short activities.
6. *Systematic probing and reinforcement*: use of probes and daily feedback.

To summarize, special education provides a rich literature validating several instructional techniques for a variety of learners. Specifically, the literature supports the combined use of DI and strategy instruction, which together emphasize explicit practice, task sequencing, teacher modeling, the use of advanced organizers, and systematic probes.

Evidence from Neuropsychological Rehabilitation

Motivated to identify effective interventions for people with memory impairments related to disease or trauma, neuropsychologists have published a large body of research on instructional methods, evaluating several instructional practices from the special education literature. For example, teacher modeling, an effective instructional technique intended to reduce the risk of errors during the acquisition phase of learning,[15] has been extensively studied under the label "errorless" learning in the neuropsychology field.[11] Similarly, a form of distributed practice called "spaced retrieval" has been shown to be effective with individuals with memory impairment related to dementia, stroke, and TBI.[7,8,31–35]

As part of the ANCDS evidence-based practice project, we conducted an extensive search and review of the instructional literature from 1994 to 2005. This search yielded more than 30 relevant studies, ranging from single-case to randomized-control group research designs. Studies of errorless learning and related techniques constituted the majority of the instructional research studies found in the neuropsychological rehabilitation literature. The next two sections summarize this research.

ERRORLESS LEARNING

The primary goal of errorless learning is to reduce substantially, if not eliminate, errors during the acquisition phase of learning.[11,36] Elimination of errors is achieved by (1) breaking down the targeted task into small, discrete steps or units; (2) providing sufficient models *before* the client is asked to perform the target task; (3) encouraging the client to avoid guessing; (4) immediately correcting errors; and (5) carefully fading prompts.[11,15,36] Errorless learning is contrasted with errorful learning (i.e., trial-and-error learning, discovery learning), in which the client is encouraged to guess the targeted response before being provided with the information.[11,36,37a] The benefits of errorless learning are typically reported in individuals with relatively spared procedural memory (memory without recalling the experience of learning) and severe, declarative memory loss (memory involving conscious recollection).[11,37a,38*]

Wilson et al[11] were among the first investigators to explore errorless learning as a method for teaching new information to individuals with severe memory impairment. The authors compared three groups of participants in their ability to learn two lists of five-letter words using a stem completion procedure. The groups included 16 individuals with severe memory impairments of various etiologies, including TBI, encephalitis, and stroke; 16 normal younger controls; and 16 normal older controls. In the "errorful" condition, participants were allowed to make errors during the initial learning trials; in the "errorless" condition, errors were prevented. Three learning trials were followed by nine test trials in each condition, all of which used the stem completion procedure to test recall. The results showed that the amnesic participants significantly benefited from errorless learning.

Wilson et al[11] then explored the use of errorless learning applied to "everyday tasks" (e.g., face-name associations of rehabilitation ward staff, programming an electronic organizer) in a series of case studies. As in their first experiment, errorful and errorless learning conditions were compared. For example, in one case, a 35-year-old man with severely impaired delayed recall and declarative learning was taught two different sets of functions on an electronic organizer, one in each learning condition. In the errorful condition (entering a telephone number), the examiner demonstrated the six programming steps and then asked the participant to attempt the task. Corrective feedback was provided after each step. In the errorless condition (writing a memo), the participant was initially taught the six steps using a forward chaining procedure, but he became bored with this method of instruction; hence, during the remaining trials, he was required to follow written instructions as an alternative method of preventing errors. In each condition, retention of steps was tested across four probe trials following a 5-minute break after the training trials. No written instructions were provided during the probes. The participant correctly recalled 100% of the steps learned in the errorless condition (24/24 total steps across four trials) compared with 58% (14/24) in the errorful condition. The authors did not report on the maintenance of skills learned or generalization to untrained skills.

The authors concluded that errorless learning was superior to errorful learning for individuals with severe memory impairments and could be applied across a variety of ecologically valid tasks that may potentially increase

**The memory systems (e.g., nondeclarative versus declarative) associated with improvements under errorless learning conditions are a subject of some debate. Experimental evidence and reviews centered on this topic may be found in several sources (e.g., Evans et al, 2000[37a]; Hunkin, Squires, Parkin, and Tidy, 1998[37b]; Riley et al, 2004[40]; Tailby and Halsam, 2003[44]; Wilson et al, 1994[11]) but are not specifically addressed in this review.*

independence and improve quality of life. The authors cautioned, however, that errorless learning is not perfect and that it is difficult to avoid errors completely during the learning process. They suggested that one way to enhance the benefits of errorless learning would be to combine it with expanded rehearsal (i.e., spaced retrieval),[39] a technique that is described in a later section.

The benefits of errorless learning have been extended to other populations, including individuals with dementia and schizophrenia, who, like those with ABI, may experience difficulty learning new skills and information. Clare and colleagues[7] found that errorless learning combined with spaced retrieval reduced the frequency of everyday memory problems for five of six individuals with Alzheimer-type dementia. These participants demonstrated significant improvements in recalling target information or strategies immediately after treatment and, in some cases, up to 6 months later. The results were later replicated in a controlled experiment involving 12 individuals with early-stage Alzheimer-type dementia who were retaught face-name associations.[8] The participants demonstrated significant improvements learning explicitly trained items. This was maintained over 6 months after treatment, but participants did not improve in learning items that had not been taught (i.e., generalization did not occur).

Kern et al[9] compared the benefits of errorless learning with conventional instruction when applied to teaching two entry-level job tasks (index card filing and toilet tank assembly) in a controlled study involving 65 individuals diagnosed with schizophrenia or schizoaffective disorder. The participants were randomly assigned to either a treatment (errorless learning) or control (conventional learning) group. The errorless learning group was exposed to simpler task components first, proceeding in a stepwise fashion to more complex task components. Frequent instruction was provided, and participants met the criteria for mastery at each stage before advancing to the next. The conventional group received "verbal instruction, a demonstration, time for independent practice, and supervisor feedback at the midpoint and end of the training session" (p. 1922). Although the conventional group received more practice time and less instructional time than the errorless learning group, the groups were equated for overall session time. The errorless group demonstrated significantly higher accuracy than the conventional instruction group on both the card filing and toilet task assembly. There were no significant group differences in speed of performance, and the errorless learning group demonstrated better overall productivity. Both groups showed declines in performance 3 months after the cessation of training, and therefore generalization of skills to other procedural tasks was not reported.

The studies targeting errorless learning of procedures[9,11] used specific task analyses with modeling followed by systematic practice of discrete steps. Hence, these studies are consistent with the findings in the DI literature suggesting that task analysis, modeling, and repeated practice are effective instructional practices.

The literature clearly supports the benefits of errorless over errorful learning techniques for individuals with declarative memory impairments, across different populations and over a wide range of tasks. Results from additional studies, however, qualify that the benefits of errorless learning may depend on several variables. For example, the degree of memory impairment has been shown to be a factor, as individuals with more severe memory impairments may show more robust improvements in learning with error-free methods than those with lesser impairments.[37a,40] The type of training task and recall conditions may also affect outcomes.[37a,40,41] For example, Thoene and Glisky[41] showed that explicit, mnemonic techniques were more effective than implicit techniques when instructing arbitrary face-name associations, whereas implicit techniques may prove more beneficial with perceptual-orthographic information (e.g., stem completion tasks).

There are several factors that have been shown to increase the effects of errorless learning and improve instructional outcomes. As discussed next, specific practice and stimulus presentation regimens[42] and increasing the amount of effort expended by the learner[43,44] have been shown to facilitate errorless learning effects.

CONDITIONS THAT MAY FACILITATE ERRORLESS LEARNING

High Amounts of Correct Practice Consistent with the special education DI literature, frequent, correct practice has been shown to facilitate learning and retention, particularly when combined with distributed practice.[24,28] Hunkin, Squires, Aldrich, and Parkin[42] used an errorless learning instructional package emphasizing frequent practice to train a 33-year-old man with severe memory impairment secondary to viral encephalitis on selected word processing tasks. After repeated errorless recognition exercises with the targeted tasks, timed practice exercises were repeated nine times during each session until accurate performance was achieved. Practice exercises subsequently were reduced to three times, then once per session, depending on the task. The participant successfully learned the targeted word processing tasks to the point that he did not require any instructions. Frequent practice both within and across sessions might have facilitated the participant's improved performance. Maintenance and generalization were not specifically addressed.

Distributed Practice-Spaced Retrieval The benefits of spaced presentation (i.e., the spacing effect) and distributed practice have been well supported in the special education literature,[24,28] in individuals without disabilities,[45,46] and more recently in individuals with TBI.[31,34,35] These studies suggest that recall of information is facilitated when practice trials are spaced or distributed rather than massed.

A study by Hillary et al[34] showed that individuals with moderate-severe TBI demonstrated significantly improved word list recall following spaced versus massed presentations of targeted words. Spaced retrieval (i.e., expanded rehearsal) is one form of distributed practice that provides individuals with severe memory loss practice at successfully recalling information over expanded time intervals. Successful recall over expanded time intervals is thought to enhance the "durability" of learning.[39] Spaced retrieval training has been used successfully to teach individuals with severe memory impairments resulting from dementia or stroke to remember very specific, personally relevant information or procedures.[7,8,32,33]

Forward and Backward Chaining Chaining techniques are frequently used to teach multistep tasks to learners with severe disabilities.[47] In forward chaining the learner begins with the first step in the sequence, and in backward chaining the learner begins with the last step. With both techniques, each new step is individually taught and linked sequentially to the previous step. The learner moves on to a new step as soon as the current step is mastered.[47]

The method of vanishing cues (MVC) is a form of backward chaining that provides the client with progressively weaker cues following successful recall of targeted information.[40,48–51] There are two common variations of the MVC, distinguished on the basis of when the correct information is initially provided. In the first variation, the targeted information is not provided at the outset of training. Rather, the client is initially asked to recall the targeted information without cues, and then cues are progressively added following incorrect responses and removed following correct responses.[48] In the second variation, the targeted information is provided at the outset of training; then, with each successful recall trial, one cue at a time is removed, starting with the final piece of information.[49,51]

Regardless of the variation used, the MVC is not considered an entirely error-free training approach, as the risk of errors increases as cues are removed. Yet, the effort required to recall information using the MVC (at the risk of increased errors) may facilitate encoding and therefore later recall.[40,51] The risks and benefits of more errorful and effortful approaches are discussed in the next section.

Effortful Processing and Self-Generation Some errorless learning procedures require very little effort, which may in fact be insufficient to encode information consciously for later recall.[37,51] In addition, tasks that involve little effort or concentration allow individuals to engage in internal multitasking as they think about other things while performing the task.

On the other hand, effort is not risk free; greater effort may produce a higher number of errors,[44,51] as was just described. Ideally, training tasks should be carefully designed to increase the effort level required to perform a task while keeping errors to a minimum.

Tailby and Haslam[44] evaluated two forms of errorless learning in individuals with acquired mild, moderate, or severe memory impairments of varying etiologies (e.g., TBI, hypoxia, dementia). The authors compared performance on a word recall task across three conditions: (1) *errorful learning*, in which the examiner might ask a question such as, "I'm thinking of a five-letter word beginning with BR. Can you guess what that word is?"; (2) *errorless learning (examiner-generated answers)*, in which the examiner might say, "I'm thinking of a five-letter word beginning with BR, and the word is 'BREAD'. Please write that down"; and (3) *errorless learning (self-generated answer)*, for example, "I'm thinking of a five-letter word beginning with BR, and this word describes a food made of flour, liquid and yeast which is baked and then sliced to make sandwiches. What do you think the word might be?" The participants demonstrated significantly better performance in the self-generated condition versus the examiner-generated condition and had higher scores in both of these errorless learning conditions relative to the errorful control condition. To summarize, the elaborated descriptions provided by the examiner in combination with the participant-generated answers provided an error-free, yet effortful learning context.

In another example, Kalla, Downes, and van den Broek[43] combined errorless learning with stimulus pre-exposure techniques to facilitate the learning of face-name pairs. The four training conditions were (1) *errorful learning*, in which participants were given the surname, then asked to guess the first name; (2) *errorless learning*, in which participants were presented with the full name; (3) *errorless plus preexposure 1*, in which participants were asked a series of evaluative, yes-no questions about the person depicted in the photo (i.e., questions concerning traits such as ambition, diligence, friendliness), then were given the full name, as described previously; and (4) *errorless plus pre-exposure 2*, which was the same as pre-exposure 1 except that the participants were pre-exposed to the surname, then given the full name. The results showed that errorless learning was superior to errorful learning on all but the recall of surnames. Moreover, the pre-exposure conditions produced significantly enhanced learning over the standard errorless learning condition (2). With one exception, there were no significant differences between the two pre-exposure conditions. The authors concluded that pre-exposure alone is insufficient to enhance the effects of errorless learning and that it should be combined with an elaborative encoding technique as just described.

To conclude, the two studies just discussed demonstrated the use of structured elaboration to enhance the benefits of successful instructional approaches by either (1) the examiner providing carefully planned descriptions of the target item prior to a participant-generated answer[44] or (2) the examiner asking evaluative questions prior to providing the correct answer to the participant.[43] Elaboration and evaluative questioning are part of the previously described strategy instruction approach reviewed in the special education literature.[21,24,28]

EVALUATION OF AN INSTRUCTIONAL PACKAGE

Ehlhardt, Sohlberg, Glang, and Albin[52] developed an instructional package (TEACH-M) based on evidence from special education and neuropsychological rehabilitation research. The purpose was to identify and evaluate an instructional sequence that would facilitate successful learning and retention in people with severe memory impairments related to ABI. The individual components of the instructional package are listed in Table 2.

To measure the effects of TEACH-M, Ehlhardt and colleagues[52] evaluated the achievement of learner outcomes by four individuals with severe memory and executive function impairments who were taught a multistep email procedure using the instructional package. The results of a multiple-baseline across-participants study revealed that TEACH-M was effective. The four participants learned the seven-step email procedure,

Table 2 TEACH-M Components[52]

Component	Description
Task analysis	Know the instructional content. Break it up into small steps. Chain steps together.
Errorless learning	Keep errors to a minimum during the acquisition phase. Model target step(s) before the client attempts a new skill or step. Carefully fade support. If an error occurs, demonstrate the correct skill or step immediately and ask the client to do it again. Use simple, consistent instructional wording.
Assessment	Initial: assess skills before initiating treatment for the first time. Ongoing: probe performance at the beginning of each teaching session or before introducing a new step.
Cumulative review	Regularly integrate and review new skills with previously learned skills.
High rates of correct practice	Practice the skill several times. Distributed practice encourages this.
Meta-cognitive strategy	The prediction-reflection technique can be used to encourage active processing of the material or another appropriate strategy that encourages self-reflection and problem solving.

reaching the criterion for mastery (100% accuracy for three consecutive sessions) within 7 to 15 training sessions. Three participants retained the email procedure after a 30-day break, and all participants generalized their skills to an untrained interface. Further, all four participants were enthusiastic about the teaching program, stating that they would recommend it to a friend. The instructional components they found most helpful included instructor modeling of steps and having four or five treatment sessions each week.

SUMMARY

A review of the instructional literature from the fields of special education and neuropsychological rehabilitation supports the use of several instructional practices for teaching a variety of populations with impaired learning. This literature suggests that the methods involved in selecting instructional targets and presenting and reinforcing target material determine learner outcomes. DI combined with strategy instruction has been shown to be a more effective approach than either method alone, at least for teaching children and adults with learning disabilities. Errorless learning techniques have been shown to be effective in training individuals with severe declarative memory impairments of a variety of etiologies, including TBI. Overall, there is increasing evidence that learners with severe cognitive impairments can learn new skills and information when provided with systematic instruction. We conclude with a checklist of instructional practices supported by experimental research, to help clinicians plan therapy sessions that are grounded in solid instructional theory (see Table 3).

FUTURE DIRECTIONS

The existing research on instructional techniques is promising, and future research should expand on the preliminary findings discussed here and their use for individuals with TBI. The findings to date indicate that goals may be achieved in relatively few sessions, suggesting that the techniques might be effective in the limited number of treatment sessions typically available given the current restrictions in rehabilitation funding. It will be necessary, however, to learn more about specific elements of these techniques that are effective. For example, are all the steps routinely included in DI necessary to achieve improved learning in the short-tem, and which steps are necessary to ensure maintenance of learned skills and generalization to untrained skills?

Given the preliminary evidence provided here, instructional practice should become a

Table 3 Instructional Checklist for Applying Evidence-Based Instructional Principles

Lesson Phase	Instructional Components and Activities	Example (Using Memory Book Training)	Checklist
I. Before session	*Assessment:* Conduct a functional assessment of relevant skills and information.	Assess client's ability to record appointments in memory book.	☐
	Task analysis: Develop an individualized task analysis based on functional assessment results.	1. Read appointment card 2. Locate month 3. Locate date 4. Record appointment	
	Examples and settings: Develop multiple training examples and establish functional training contexts to facilitate generalization.	Use several appointment cards with various dates and engagements. Practice recording appointments in multiple settings (e.g., doctor's office, meeting with counselor).	☐
II. Beginning of session	*Assessment:* Conduct probe at the beginning of each treatment session to evaluate skill retention.	Independent with steps 1 and 2. Unable to perform steps 3 and 4.	☐
III. During session	*Errorless learning:* Model new target step(s) before client attempts task.	Begin with modeling step 3, two or three times.	☐
	Carefully fade cues and prompts.	Provide verbal prompts, coaching until independent on step 3.	☐
	Chain steps.	Chain step 3 to steps 1–2 and practice.	☐
	Immediately correct errors (isolate and model, and practice step again).	If client makes an error on step 3, immediately provide another model.	☐
	Use simple, consistent instructional wording.	''Next, find the date.''	☐
	High rates of correct practice: Ensure frequent, correct, and distributed practice.	Practice target step(s) several times to facilitate mastery.	☐
		Take a break, then repeat practice with target step(s).	☐
	Metacognitive strategy: Train client self-evaluation.	Ask client to predict performance on next practice trial, then to reflect on how it went.	☐
IV. End of session	*Cumulative review:* Integrate and review new skills with previously learned skills.	Review and practice steps 1–3.	☐

part of the graduate school curriculum for students preparing to become speech-language pathologists. We strongly advocate for increased education about instructional practices for clinicians working with people with cognitive impairments, as part of the larger mission to instruct students in the use of evidence in clinical practice.

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