Tutorial: Self-Regulation / Executive Function Routines after TBI

WHAT IS SELF-REGULATION?

An important goal of the educational system is to have children learn how to regulate their behavior so that they deliberately act in a way that is consistent with school and social rules and the needs of others, and that is also strategic in relation to their learning and academic success. The same self-regulatory skills underlie social/behavioral self-regulation (e.g., inhibiting impulses, deferring gratification, benefitting from feedback) and cognitive-academic self-regulation (e.g., strategic reading, effective studying, taking responsibility for academic success).

Self-regulation (sometimes referred to as executive functioning) develops very gradually in children, beginning in infancy and continuing through the adolescent years. The development of self-regulation is positively influenced by:

1. Neurologic maturation, especially development of the frontal lobes of the brain;
2. Stability, organization, and predictability in the home environment;
3. Reasonable emotional attachment of children to important adults in their life;
4. Adequate opportunities for children to exercise control over events in their life;
5. A parenting style that steers between the extremes of permissiveness (at one end) and an overly authoritarian and controlling style (at the other end). Many people call this middle ground an "authoritative/responsive" style of parenting;
6. An environment that models, values, and rewards self-regulation, autonomy, and personal responsibility;
7. Reasonably effective development of language, for communication as well as for problem-solving and self-regulatory self-talk;
8. Positive adult-child interactions that include the regulatory words, procedures, and themes that will eventually be internalized by children to become their internal self-regulatory system. Adult interaction with children, if well conceived and frequently repeated, ultimately becomes appropriated by the children as an internal self-regulation system (see below). Adult words, if well selected and used on the right occasions, become the child's self-regulatory thoughts.
9. Development of a coherent and positive sense of self.

WHY IS SELF-REGULATION IMPORTANT FOR MANY STUDENTS AFTER TBI?

Many children arrive at school with relative (and in some cases extreme) self-regulatory immaturity. They regulate their behavior poorly (e.g., impulsively grabbing or lashing out at other children); they regulate their emotions poorly (e.g., crying when impulses cannot be satisfied); and they regulate their cognitive and academic behavior poorly (e.g., not planning before starting a task, not monitoring their work, not using strategic procedures to succeed with difficult tasks). In this respect they may be much like preschoolers even though their physical and perhaps intellectual development is at a much higher level.

Students with brain injury often have significant difficulty with self-regulation because of damage to the frontal lobes, the part of the brain most commonly associated with self-regulation (or executive functions). Their self-regulatory difficulties might include any combination of the following (all relative to age expectations):

1. Weak understanding of their own abilities and needs
2. Difficulty setting reasonable goals for themselves
3. Difficulty making plans to achieve their goals
4. Difficulty organizing their behavior, their thinking, and their talking.
5. Difficulty inhibiting impulses; acting impulsively

6. Difficulty initiating needed activities or strategies at the right time
7. Difficulty monitoring their own performance and evaluating it in relation to their goals
8. Difficulty thinking and acting strategically in relation to their goals; difficulty solving problems in an organized manner
9. Difficulty learning from consequences
10. Difficulty learning a skill in one setting or context and transferring it to another
11. Difficulty shifting flexibly from one activity to another, from one thought to another, or from one strategy to another

Depending on the severity of the injury, these problems may be observed in the early weeks or months after the injury, but then resolve as the student recovers. In other cases, some combination of these problems remains constant due to specific frontal lobe injury. When children are injured at an early age, the problems with self-regulation may become more severe over the years after the injury because the child is expected to mature in these domains of functioning, but does not because of the injury to the brain. Thus the problems may appear to be more severe as the student ages.

WHAT ARE THE MAIN FEATURES OF INTERVENTION AND SUPPORT THAT ARE IMPORTANT FOR STUDENTS WITH SELF-REGULATION PROBLEMS AFTER TBI?

UNDERSTANDING THE PROBLEM

As with all problems, step one is understanding the problem. Self-regulation problems are easily misidentified as behavior problems. For example, educators may assume that a student with initiation problems is deliberately resistive of school work. Or a student with inhibition problems may be judged to be "acting out". Or a student with self-monitoring problems may be seen to lack concern for the quality of his work. Psychological testing may help to identify specific self-regulation/executive function problems. The problem-solving system on this web site may help teachers and parents sort out contributors to the student's difficulties using the contexts and routines of everyday life in school and at home.

In addition to students with TBI, many other populations of students are vulnerable for problems with self-regulation. These include ADHD, autism, fetal alcohol syndrome, learning disabilities (in some cases), students from challenging environments and disorganized home environments, and others.

ENVIRONMENTAL SUPPORTS

Maturation of self-regulation is very gradual from infancy to adulthood. But in thinking about students who are immature in this domain, it is often useful to think in common sense terms about how parents manage two year olds. In managing the behavior of a two-year old – or of students with significant self-regulatory problems – the following nine principles of environmental management are most important.

1. "Childproof" the environment (see five types of "child proofing" below).
2. Create everyday routines of activity and interaction that are well understood by the students and effectively supported, so that they experience success in their lives.
3. Expect impulsive and poorly regulated behavior from time to time, especially if the student is tired or stressed, there are changes in routine, the environment is overly stimulating (or possibly under-stimulating), or demands are high. Remain calm. Adult anxiety and agitation increase the student's anxiety and agitation.
4. Don't expect immature students to routinely regulate their behavior effectively – control impulses and defer gratification – in relation to a distant goal (e.g., control impulses now in order to get a reward or avoid a punishment at the end of the day) or an abstract rule (e.g., "think about others' needs, not just your own").

5. Use behavior management procedures that are proactive, positive, and supportive. That is, set the student up for success rather than reacting to his failures. Negativity and punishment usually breed a downward cycle of more negativity and punishment with developmentally young children. (See behavior management suggestions below.) (**See Tutorials on Behavior Management: Prevention Strategies; Positive Behavior Supports**)
6. Use an interactive and teaching style that is positive and supportive (versus threatening and "testing"). (See "General Teaching Interaction" below.)
7. Use everyday conversational routines of interaction that are designed to become internalized by the students as their own self-regulatory system. (**See "Self-Regulation Scripts"** below.)
8. Ensure that instructions and expectations are clear. Use consistent instructional routines and concrete (e.g., graphic) organizational supports liberally. (**See "Concrete Graphic Organizers"** below.) (**See Tutorials on Instructional Routines; Graphic Organizers; Apprenticeship Teaching**)
9. Help the child develop a sense of self that includes competence and a desire for self-regulation. (**See Tutorial on Sense of Self**.)

"CHILD PROOFING"

In a school setting, "child proofing" the environment has the following components. Of course there are many degrees of support under the heading "child proofing," ranging from total support to minimal support. Good judgment is required in deciding how much support should be provided at any given time in any given context. As with all support-oriented interventions, the supports should be systematically reduced as the student gains competence.

1. Childproof the physical environment: Make sure that students with self-regulatory weakness are not exposed to dangerous situations; make sure that they are not overly tempted by readily accessible and highly desirable objects or activities that predictably distract them from the task at hand or elicit impulsive or negative behavior.
2. Childproof the activity environment: Make sure that the students are capable of doing all that is expected and requested of them. The comments below about flexible supports and collaborative ("team") participation and teaching (versus solo performance) are relevant here. If the adult is the student's collaborator (i.e., partner or team member – versus tester or drill master), then the students will always be able to complete the task – and can become more independent as they gain competence.
3. Childproof the social environment: Make sure that students are with other students with whom they are reasonably compatible. Prevent social interactions that are threatening or cause agitation. Make sure that trained and supportive adults are with the students during predictably difficult times and tasks.
4. Childproof the expectation environment: Make sure that expectations for the student's performance, participation, and self-regulation are appropriately adjusted relative to abilities, stressors, moods, illness, tough times, and the like. For example, parents of two-year olds try hard to make these adjustments – and it is important in school as well, in the case of students who are particularly immature in self-regulation.
5. Childproof the known stressors, such as transitions and changes in routine: Students with self-regulatory weakness are notorious for having difficulty with transitions (even apparently simple transitions from, say, snack back to work) and changes in routine. Try to insulate the student from such known stressors with good preparation and special support during the transitions and at times of change in routine. (See **Tutorials on Flexibility; Transition Routines.**)

INSTRUCTIONAL STRATEGIES TO ASSIST STUDENTS WITH SELF-REGULATORY DIFFICULTIES

See Tutorials on components of self-regulation for instructional strategies specific to that component: Self-Awareness; Organization; Advance Organizers, Inhibition; Initiation; Self-Monitoring; Cognitive and Learning Strategies; Problem Solving; Flexibility; Anger Management; Egocentrism; Sense of Self.

General Self-Regulation (Executive Function) Scripts /Routines For Use at Home and at School

What follows are some thoughts about the concept of executive function or self-regulatory scripts for use with students with self-regulatory problems. The core idea is that *self-regulation is internalized self-talk* – and children need to learn this self-regulatory self-talk at school and ideally at home as well. Self-regulation as internalized self-talk is a theme that applies to all children. However, it is a particularly important theme for children who do not "pick up" self-regulatory self-talk in the ordinary course of everyday interaction with adults and older children.

The general goal is to create a large number of opportunities over the course of everyday activities at home and at school for students to engage in these scripts with staff and family. Initially, the script will be mainly the responsibility of the adult (teachers, assistants, therapists, parents, others). Gradually the students should be able to contribute some aspect of the script. In other words, the scripts should start as adult statements (e.g., "John, I think this might be hard for you … because we just started fractions and they are tricky … so you'll probably need to ask me for help when you get stuck; I know that will work, OK??"). As the student gains competence, the scripts can become questions (e.g., "John, do you think this will be hard or easy for you? … And why do you think it might be hard? … So what do you plan to do to succeed?"). Ultimately the questions might be replaced with simple gestures, triggering the appropriate self-regulatory script from the student. The ultimate goal is that the script will be internalized by the student so that it becomes his self-regulatory thought process. This may potentially take years and a very large number of learning trials.

The scripts can easily be used with a small group of students or an entire class, as well as in one-on-one interaction. Many teachers who take self-regulation seriously create posters of the self-regulation scripts (or just their titles, like "Big Deal/Little Deal") and display them on the classroom walls. In this way the teachers remind themselves to use the scripts routinely with the class as a whole as well as with individual students. Thus a culture of self-regulation is created in the classroom and ideally throughout the school. In schools that have adopted this culture of self-regulation, principals have reported decreases in disciplinary referrals, decreases in referrals to special education, and increases in academic performance as measured by standardized tests.

Cautions and Reminders: The following cautions and reminders are in order:

1. The specific words may need to be modified to fit individual students' age, vocabularies, and sensitivities.
2. These scripts should be pleasant. Adults must be careful to avoid turning them into threats, nagging, or other irritating interactions. Under those negative circumstances, the scripts would be counter-productive – students would predictably come to hate self-regulatory coaching. For example, if a teacher says angrily to the students, "You must show me you're ready and show me right now!!", the students will come to have negative associations with the "ready/not ready" script and never accept it and internalize it as their own self-regulation. Similarly, if a teacher threatens a student by saying, "You have a choice, young man; You can get your work done right now or you can get sent home!!", the student will have negative associations with the "choice/no choice" script and never accept it and internalize it as his own self-regulation.
3. The scripts should be used routinely on those occasions when it would be desirable for the students to have in their heads the self-regulatory thought that is articulated by the script. For example, when faced with a new task, all students (and adults) should automatically ask themselves if the task might be difficult, if so why, and if so what they are going to do to succeed. Therefore, on the occasion of presenting a new task, the teacher should use (or elicit) the "Hard/Easy" script. Similarly, when faced with a situation that might be stressful, all students (and adults) should automatically ask themselves if the situation is really a big deal, if so why, and if so what they plan to do about it. Therefore, on the occasion of sensing a potentially stressful situation, the teacher should use (or elicit) the "Big Deal/Little Deal" script. This script can often be used to diffuse situations – to help the student see that a situation that seems like a big deal is really not such a big deal.

4. The scripts should mainly be used under positive circumstances so they have positive associations. For example, the "big deal/little deal" script should mainly be used for positive "big deals" or non-stressful "little deals". It may be tempting for staff to use the scripts mainly or only when they feel a need for behavior management tools – that is, during negative times. Unfortunately the scripts will come to have negative associations under those conditions. Staff should ensure at least one or two uses of the scripts under positive conditions for every one use under stressful conditions. The goal is to create positive associations – and avoid negative associations – with the scripts.
5. The scripts must be used frequently. The ultimate goal is for the student to bring the relevant self-regulatory script to mind automatically when the situation calls for it. Over time the student may begin to use the scripts without even bringing them to conscious awareness.
6. Adults must decide which of these scripts are most important, so as to avoid overwhelming the student with too many scripts.
7. In some cases, the scripts should be presented in a highly "telegraphed" manner – with very few words. Adults should make good judgments about how much language and discussion to use with a specific script. For example, it is not wise to allow the scripts to devolve into an extended argument.
8. Adults should pull back supports as the student acquires and gradually internalizes the scripts. For example, the progression can be from the adult stating the script to the adult asking scripted questions to the adult simply signaling to the student that a self-regulatory script is relevant to, finally, no support.

In working with adolescents, the scripts or routines can be called "Self-Coaching Plays". The sports metaphor might make the scripts seem more mature and appealing for that age group. But the general ideas are the same.

GENERAL FORMAT FOR THE MOST GENERAL SELF-REGULATORY SCRIPT

What follows is a general outline of how people achieve success when tasks are difficult. One of the goals of education is to plant this important self-regulatory template into the heads of the students – particularly those with disability, because they face more difficult tasks than students with no disability. This script can be used routinely as a template for any deliberate efforts that the students make academically or socially. Teachers can use this script formally, possibly even recording the student's responses on a form. More commonly the script is used informally and conversationally, possibly omitting parts (e.g., the prediction). Thus it needn't take much time to complete this script or any of the more specific scripts listed below.

GOAL: What's the goal? What are you trying to achieve? What do you want to have happen? What's it going to look like when you're done?

OBSTACLE: What is standing or could stand in the way of you achieving the goal? What is the problem?

PLAN: So what's the plan? What do you need to do? Do you need help? Do you want to do it as a team? Do you think that plan will work??

PREDICTION: So how well do you think you will do? How many can you get done? On a scale of 1 to 10, how well will you do?

DO: [Perhaps solving problems along the way or revising the plan]

REVIEW: So how'd it work out? What worked? Anything that didn't work? Why or why not? What are you going to try next time?

Video Illustration of Goal-Obstacle-Plan-Do-Review Script

GENERAL FORMAT FOR SPECIFIC SCRIPTS

What follows are more specific scripts that might be selected as particularly important for specific students – or for the class as a whole. They all can follow the format outlined below – for ease in adult learning:

1. Identify/label the issue (e.g., "This seems to be a problem; This is kind of scary; This is a big deal; I think this might be hard for you.")
2. State the reason (e.g., "It's a problem because…; It's scary because …; It's a big deal because…; It's hard because".)
3. Offer a strategy (e.g., "We (or you) can do ….; that should help")
4. Offer general reassurance (e.g., "Great; there's always something that works, isn't there?")

Students will not internalize these critical self-regulatory scripts unless the scripts first become a habit for adults in their interactions with the students.

Problem-Solving/Strategic Behavior Script
Importance: All students need to become progressively better problem solvers. However, people with disability need to be more strategic (better problem solvers) than people with no disability because they face so many problems/difficulties in school and in their lives. Often they receive little practice in strategic thinking/problem solving because family and education staff do their strategic thinking/problem solving for them. In typical child development, there is very gradual development in this domain from infancy into adulthood.

Script:

1. Identify/label the issue (e.g., "This seems to be a problem.")
2. State the reason (e.g., "It's a problem because…")
3. Offer a strategy (e.g., "Maybe we/you can ….; that should help.")
4. General reassurance (e.g., "Great; it worked; there's always something that works, isn't there?")

Gradually reduce external support (e.g., switch from statements to questions) as the student gains competence and it becomes possible to do so.

Hard To Do/Easy To Do Script

Video Illustration of this script.

Importance: This is a critically important self-regulatory routine for people with disability – because it is necessary to know that something is difficult to do if one is going to work hard or be strategic to get it done. People with disability need to work hard and be strategic to get things done. Therefore, it is critical for them to be able to identify what is hard to do versus what is easy to do.

Script:

1. Identify/label the issue (e.g., "This is kind of hard to do, isn't it?" – or medium hard or pretty easy)
2. State the reason (e.g., "It's hard/easy to do because…")
3. Offer a strategy (e.g., "Maybe you should ask for help? Or …." Or "It's easy because you did …")
4. General reassurance (e.g., "Great; that was kind of hard to do – but you asked for help and we did it. There's always something that works, isn't there?")

Gradually reduce external support (e.g., switch from statements to questions) as the student gains competence and it becomes possible to do so. Because many students are anxious and acutely aware of some of their difficulties, it is important that most of these interactions highlight what is easy for them –

and that the "hard to do" scripts remain positive in the sense that the focus is on the strategy and success, not on the inability.

Ready/Not Ready Script

Video Illustration of this script

Importance: This is a critically important self-regulatory script for students who are impulsive, for example those who may start a task without a plan or without needed materials, and then experience frustration due to inevitable failure. Success in completing tasks often requires doing something to get ready. Therefore this is an important habit to develop.

Script:

1. Identify/label the issue (e.g., "I'm not sure that you're ready")
2. State the reason (e.g., "You're not ready because you don't have .....")
3. Offer a strategy (e.g., "I'll know you're ready when you....")
4. General reassurance (e.g., "Great; you look ready. There's always something that works, isn't there?")

Gradually reduce external support (e.g., switch from statements to questions) as the student gains competence and it becomes possible to do so.

Big Deal/Little Deal Script

Video Illustration of this script.

Importance: The long-term importance of having this self-regulatory script is: (1) to help students distinguish what is important from what is not important – so they might be less anxious about little deals and take big deals seriously; (2) possibly to help them break a perseverative set; (3) possibly to help them avoid negative behaviors when staff need to move beyond something that is really unimportant; (4) possibly to help students avoid negative interaction with other students over minor provocation; (5) possibly to get the students engaged in something important at a time when they would prefer not to.

There may be a need to experiment for purposes of identifying the best words to use. Also, start the "Big Deal" script at times when the students are not upset. It is important to avoid creating negative associations with this script from the start.

Script:

1. Identify/label the issue (e.g., "This is a big deal.... or this is not a big deal – this is just a little deal – this is not important.")
2. State the reason (e.g., "This is just a little deal because we can .....")
3. Offer a strategy (e.g., "Maybe we can ....")
4. General reassurance (e.g., "There we go. You see, that was not a big deal. That was just a little deal. And there's always something that works, isn't there?")

Gradually reduce external support (e.g., switch from statements to questions) as the student gains competence and it becomes possible to do so.

Scary/Not Scary (Safety Judgment) Script

Importance: The long-term importance of this self-regulatory script is: (1) to help develop students' safety judgment; (2) to help them learn from experience. Again, there may need to be experimentation to find the best words to use. More mature language should be used with older students, for example the "safe/not safe" script.

Script:

1. Identify/label the issue (e.g., "This is kind of scary.")
2. State the reason (e.g., "It's scary because you could fall and hurt yourself.")
3. Offer a strategy (e.g., "But if you ..... you will be very safe.")
4. General reassurance (e.g., "There we go. You see, there's always something that works, isn't there?")

Gradually reduce external support (e.g., switch from statements to questions) as the student gains competence and it becomes possible to do so.

Choice/No Choice Script

Video Illustration of this script.

Importance: The long-term importance of this self-regulatory script is: (1) to help students learn that they have choices in some domains and not in others – and learn how to discriminate between the two domains; (2) to help them learn how to make good choices when they have a choice; (3) to help them accept "no choice" situations. Again, there may need to be experimentation to find the best words to use.

Script:

1. Identify/label the issue (e.g., "You have a choice here; or You know this is a no choice situation.")
2. State the reason (e.g., "This is a no choice deal because....")
3. Offer a strategy (e.g., "Here is what we can do to get through this.....")
4. General reassurance (e.g., "There we go. You see, there's always something that works, isn't there?")

Gradually reduce external support (e.g., switch from statements to questions) as the student gains competence and it becomes possible to do so. It is especially important to use the "Choice/No Choice" script on many positive occasions when there is a choice. If the script is mainly used when the student is upset and has no choice in the matter, then it will come to have negative associations (i.e., "nagging") and will not be useful.

Play to Change Plays Script (or "Flexibility Routine")

Importance: Many students with disability are inflexible; they appear to rely on very consistent routines and become upset when change occurs or their expectations are violated. Because they need routine, it is useful to create a "routine to change routines" or a routine to accept change.

Script:

1. Identify the issue: Ideally a change in routine is identified well in advance (e.g., "Today we are going to do .... a little differently.")
2. State the reason (e.g., "We need to do this differently because....")
3. Generate a strategy (e.g. "Let's practice the way we are going to do this today.")
4. General reassurance (e.g., "We'll get through this; there's always something that works.")

Gradually reduce external support (e.g., switch from statements to questions) as the student gains competence and it becomes possible to do so. See also the Tutorial on Transition Routines.

"What About You?" Script
Importance: Many students with self-regulatory impairment have damage or developmental immaturity in the part of the brain associated with the ability to see the world from another person's perspective. (See Tutorials on Egocentrism; Social Perception.) These students need a great deal of practice – within the routines of everyday life – trying to understand others' feelings, needs, and perceptions.

Script:

1. Identify the issue: (e.g., "What do you think John thinks about this?" Or "Why don't you ask Sally how she feels about it?")
2. State the reason (e.g., "I think John feels ..... because.....")
3. Generate a strategy (e.g. "So it would probably be a good idea for you to.....")
4. General reassurance (e.g., "Great! He's feeling better. There's always something that works.")

Gradually reduce external support (e.g., switch from statements to questions) as the student gains competence and it becomes possible to do so.

Experimental Script

Video Illustration of this script.

Importance: Students benefit from an increasingly experimental approach to what works for them and what does not work for them. That experimental orientation can be facilitated through everyday interaction between the student and teachers or parents. Furthermore, most students interpret this experimental orientation as an act of respect.

Script:

1. Identify/label the issue (e.g., "John, you and I have different ideas about how to get this done.")
2. State the reason (e.g., "We disagree because.....")
3. Offer a strategy (e.g., "Let's try it both ways and see which works best....")
4. General reassurance (e.g., "There we go. You see, there's always something that works, isn't there?")

Gradually reduce external support (e.g., switch from statements to questions) as the student gains competence and it becomes possible to do so.

TEACHING EMOTION WORDS AND ASSOCIATED CONCEPTS AND STRATEGIES THROUGH SCRIPTED EVERYDAY INTERACTION: All emotion words (and concepts) can be taught using similar scripts. For example: "I think you are angry/mad....You're angry because.... When you're angry, here's a smart thing to do.... There's always something that helps" Similar scripts can be used for teaching all emotion words – not simply so that the student can recognize the emotion (in himself and others), but also so that the recognition is associated with an understanding of what causes the emotion and what to do about it.

General Reminders About Self-Regulatory Scripts:

1. The main idea is to use words that you would like the student – at some point in the future – to use on exactly those occasions as his own self-regulatory self-talk or internal self-regulatory self-direction. You are planting self-regulation in the student's head with these scripts.

2. Modify the language to meet individual needs. For adolescents, it is often useful to use sports metaphors and to call these self-regulatory scripts "self-coaching plays". Other metaphors can be used as needed to make the self-regulatory self-talk motivating.
3. Pick the routines/scripts that are particularly important for a specific student or perhaps for the class as a whole. At the outset, do not use so many different scripts that the student is overwhelmed or confused.
4. Use a pleasant interactive style when using the scripts. Avoid nagging.
5. Use the scripts mainly under positive and non-stressful circumstances to create positive associations.
6. Use the scripts frequently.
7. Pull back supports as the student acquires and gradually internalizes the script.
8. Comfortably weave the scripts together as appropriate. For example, an experienced teacher might introduce a lesson using the Goal-Obstacle-Plan-Do-Review script. The Obstacle and Plan parts of the script might most effectively be accomplished using the Hard/Easy script. And during the Do part of the lesson, one or more Problem-Solving scripts might be used as problems arise. And during the Review part of the lesson, the Big Deal/Little Deal script might be used as a way of emphasizing the strategic lessons learned during the activity.

EVIDENCE SUPPORTING THE USE OF SELF-REGULATION INTERVENTIONS, INCLUDING SELF-REGULATORY SELF-TALK

This summary of evidence is written for teachers and others who may be required to support their intervention practices with evidence from the research literature or who may simply be curious about the state of the evidence. This summary was written in 2007. Evidence continues to accumulate.

Evidence supporting the conclusion that self-regulation in typical child development is internalized self-regulatory self-talk is summarized by Berk (2001). Evidence supporting the role of other environmental factors (listed above) in children's development of self-regulation is summarized by Bronson (2000). Landry and colleagues (2001, 2002, 2003) have shown that a positive and supportive maternal interactive style can facilitate development of self-regulatory/executive functions in typically developing and high risk children. Riggs and colleagues (2006) summarized the extensive evidence supporting a connection between self-regulatory/executive function development and social-emotional development as well as the limited evidence currently available that supports intervention programs specifically designed to improve executive functioning skills.

Few studies have been conducted to test the effectiveness of the self-regulatory interventions described in this tutorial specifically for students with a diagnosis of TBI. Feeney and Ylvisaker (1995, 2003, 2006, 2007) have used the Goal-Plan-Do-Review script, as well as several of the environmental "child-proofing" supports, as part of successful interventions for both young students and adolescents with self-regulatory weakness after TBI. Their nine published successful single-subject experiments showed that the interventions resulted in reduced aggression and increased academic productivity for all nine of the students.

Laatsch and colleagues (2007) reviewed the evidence for cognitive and behavioral interventions for children with acquired brain injury. Most of the studies that targeted problem-solving or other executive function skills embedded those interventions within more comprehensive intervention plans, prohibiting an analysis of specific components. However, the authors did conclude that meta-cognitive (i.e., executive function) and cognitive-behavioral interventions can be combined with attention training to improve functioning in that domain (versus attention process training alone). Limond and Leeke (2005) similarly reviewed the research on effectiveness of intervention for children with cognitive impairments after TBI. They identified only 11 studies and concluded that there was insufficient evidence to draw strong conclusions. However, they did conclude from the available evidence that it "may be ideal to provide broadly focused rehabilitation models targeting executive function skills, everyday tasks and adaptive functioning" (p. 349).

Studies of other populations, including young adults with TBI and children and adolescents with other related disabilities, can be used with discretion as provisional support for an intervention strategy used with children with TBI. If a specific intervention strategy has been shown to be effective across several populations, including those that overlap in impairments and needs with TBI, then a cross-population inference to TBI is reasonably justified. Ultimately of course an intervention strategy is known to be effective for a specific student by carefully documenting its usefulness with that student.

In adult brain injury rehabilitation, two systematic reviews and a meta-analysis have shown compensatory strategy instruction and executive function/meta-cognitive intervention to be evidence-based practices. Cicerone and colleague (2000) identified 14 experimental intervention studies in the areas of executive functioning and problem solving (primarily class III single-subject studies). They concluded that intervention in these two domains should be considered a practice guideline for adults with TBI. More recently, Cicerone and colleagues (2005) identified an additional 9 studies (again, mainly class III single-subject studies) that reinforced their recommendation of a practice guideline. Kennedy and colleagues (2007, in press) identified 15 studies examining the effectiveness of intervention in the meta-cognitive strategy domains of problem solving, planning, and organizing. A meta-analysis was performed on the five available randomized controlled trials. Effect sizes reflecting activity/participation outcomes after meta-cognitive strategy intervention were substantially larger than chance and than control interventions. Combined with the results of the other 10 studies they reviewed, these meta-analysis results yielded the clinical recommendation that meta-cognitive strategy intervention should be used with young adults with TBI.

Perhaps the most convincing evidence supporting the use of self-regulation scripts and routines in classrooms is the large body of experimental literature on academic strategy instruction. This literature is more thoroughly reviewed in the **Tutorial on Cognitive and Learning Strategies**. This body of evidence is persuasive because it is extensive, the studies have shown positive results throughout the school years, and a wide variety of clinical and non-clinical populations have been included in the successful studies. The larger the number and variety of populations studied, the easier it becomes to generalize findings to a relatively unstudied population.

One of the well studied self-regulation focused strategy programs is worth highlighting here, namely Self-Regulated Strategy Development (SRSD). Like several other strategy intervention programs, SRSD includes several self-regulatory scripts targeting goal setting, self-instructing, self-monitoring, and self-reinforcing. More than 30 studies have validated its use with non-disabled students, high risk students, and students with a variety of disabilities, including learning disabilities, ADHD, speech and language delay, and social/emotional disturbance. Studies have spanned grades two through high school. Much of the research has been conducted in the context of writing instruction; however, SRSD procedures can be used with a variety of curricular content. Graham and Harris (2003) presented results of a meta-analysis of 18 experimental studies that yielded large to very large effect sizes across a variety of outcome measures. Meltzer and colleagues (2007) also summarized a number of classroom-based executive function procedures and cited evidence supporting their use across student populations.

Like TBI, ADHD designates a population of students with executive function/self-regulatory impairments. The ADHD intervention research literature is much larger than the TBI literature and can, therefore, be used with discretion as a guide to successful interventions for students with TBI. Zentall (2005) summarized a large number of studies demonstrating the effectiveness of environmental support and task modification procedures to increase the likelihood of successful academic performance and behavioral self-regulation for students with ADHD. (See the "child-proofing" procedures listed above.) Many of these studies are individually summarized in her 2006 book.

Of the extensively studied interventions for students with ADHD, cognitive behavior modification (CBM, Meichenbaum, 1977) most resembles the use of self-regulation scripts described in this tutorial. Early reviews and meta-analyses of the CBM studies demonstrated initial effects of the intervention, but minimal generalization and maintenance (Abikoff, 1991; Dush et al., 1989). A similarly discouraging summary was presented by Pfiffner and colleagues (2006). In contrast, a meta-analysis by Robinson and colleagues (1999) showed moderate-to-large effect sizes of the CBM interventions for adolescents, restricting the

analysis to those studies of interventions that were implemented in the school settings where the problems were occurring. Similarly, Reid and colleagues (2005) completed a meta-analysis that showed moderate-to-large effect sizes for self-regulation interventions delivered in school settings. Zentall (2005) reported that the cognitive-behavioral strategies for students with ADHD found to be most successful to date are those that target self-monitoring, self-reinforcement, and self-evaluation.

A take-home lesson from the academic strategy training and ADHD literatures is that there is reason to implement self-regulation scripts within the routines of everyday life in school and at home (versus in a clinical setting) – intensively and long term – as recommended in this tutorial. That is, self-regulation interventions and supports should become a component of the culture in classrooms and homes, not just a discrete "treatment" offered in clinical settings and judged after short-term intervention trials.

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