

Assessment of Self-Regulation and Related Constructs: Prospects and Challenges

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Abstract

The term self-regulation refers to the set of processes by which individuals remain on course in their pursuit of goals they have adopted. The most recent decade has witnessed an upsurge of interest in self-regulation, motivated by findings linking early demonstrations of skill at self-regulating with consequential outcomes later in life. These impressive findings suggest that skill at self-regulating may be as important as academic skill to productivity and success in adulthood. Unfortunately, efforts at assessing skill at self-regulation lag far behind those for academic skills, making diagnosis and tracking of progress difficult. In this paper, we propose a framework for organizing the sprawling literature on self-regulation and review assessment strategies relevant to categories within the framework. We conclude by reflecting on the current state of efforts at assessing skill at self-regulating and suggest next steps in the development of more effective assessment strategies.

Keywords: self-regulation, self-management executive function, assessment

Assessment of Self-Regulation and Related Constructs: Prospects and Challenges

To even the casual observer of human behavior, the wide variability in how effectively people manage their own behavior is evident. There are those individuals who routinely fulfill obligations, deal effectively with the occasional setback, and follow through on commitments; and there are those who routinely do not. The astute observer will further recognize that, among those individuals who are effectively managing their behavior, there is significant variability in the means by which they do so. Our goal in this manuscript is to discuss strategies for assessing key endowments, styles, and skills that account for the variability in effectiveness at self-regulating behavior.

The skills we discuss are not relevant for all behaviors that contribute to effectiveness and productivity. Some behaviors are governed by biological needs and therefore not routinely under the direct control of the individual. Other behaviors have become associated with cues in the environment (i.e., conditioned) and, as a result, typically are produced by those cues rather than a conscious decision by the individual. Still others are in response to the dictates of a social, political, or religious system to which the individual is, either voluntarily or by force, subject. Finally, some behaviors emanate from impulses that, if not suppressed by the individual, produce behavior. It is only when the individual becomes aware of and chooses to delay or abandon altogether behaviors governed by these mechanisms that skill at self-regulating becomes relevant.

Our focus is those behaviors over which the individual exercises discretion. These typically involve choice and virtually always have implications for one or more goals. Thus, for example, a student might be faced with the choice of whether to prepare for tomorrow's quiz or spend the evening socializing with friends. As is common with such choices, the decision

requires weighing the value of an immediate and a future outcome. Moreover, it requires the resolution between goals that are important (succeeding in school vs. cultivating or maintaining friendships) but, in the current moment, in conflict. The key characteristic, however, is that barring intervention by parents or a restriction on behavior (e.g., no transportation), the student is at liberty to choose which behavior to enact. The means by which the student is able to prioritize future outcomes, effectively prepare for the quiz given an appealing alternative, and delay rather than abandon pursuit of the social goal is the focus of this manuscript.

Although a broad range of intrapersonal variables might be brought to bear in an analysis of these behaviors and their consequences, our analysis focuses specifically on those that either directly or indirectly contribute to the activity of self-regulation. Self-regulation is an umbrella term used rather loosely by behavioral scientists to refer to the processes by which people control their behavior in the service of goal pursuit.¹ Perhaps because of the breadth of constructs, processes, and behaviors relevant to self-regulation, there is no widely accepted definition of the term. An array of what are better termed descriptions than definitions have been offered by behavioral scientists. The following are representative of these descriptions:

- “the capacity of individuals to guide themselves, in any way possible, toward important goal states” (Fitzsimons & Bargh, 2004, p. 151)
- “the capacity to plan, guide, and monitor one’s behavior flexibly in the face of changing circumstances” (Brown, 1998, p. 62)
- “self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals” (Zimmerman, 2000, p. 14)

¹ In reality, self-regulation concerns additional issues such as the negotiation and management of identity; however, given the focus of the manuscript, we restrict our focus to the control of behavior.

- “the process by which one monitors, directs attention, maintains, and modifies behaviors to approach a desirable goal” (Ilkowska & Engle, 2010, p. 266)

A core concept in these and most other descriptions of self-regulation is goal pursuit. For our purposes, a goal is defined as a “a desirable future state of affairs one intends to attain through action” (Kruglanski, 1996, p. 600). The goal an individual is pursuing at a given moment may be short- or long-term. Short-term goals are generally concrete and specific to the immediate situation (Kanfer & Hagerman, 1981). An example is the goal to save face following a gaffe. Although short-term goals may be fleeting, many are specific manifestations of more general and abstract long-term goals (Carver & Scheier, 1981). For instance, the immediate goal of saving face might be in service of a long-term goal to befriend the recipient of the gaffe. Somewhat different processes operate in the pursuit of short- and long-term goals. Although the pursuit of short-term goals often results in progress in the pursuit of long-term goals, it is those processes that contribute to the successful pursuit of long-term goals that receive most of our attention in the present treatment.

Other key terms appear with some frequency in the various descriptions of self-regulation. For example, monitoring of behavior is assumed to be critical to the process of self-regulation. Similarly, planning is key to the process, particularly for the pursuit of long-term goals. Perhaps not evident in the representative descriptions provided earlier but central in fuller treatments of self-regulation is the notion of discrepancy reduction, whereby the individual adjusts behavior with reference to a goal-related standard until it is consistent with the standard. As described more fully below, it is assumed that repeated comparisons to the standard and behavioral adjustments may be required before an instance of self-regulation has run its course.

For present purposes, we use the term self-regulation to refer to **the set of intrapersonal processes by which individuals remain on course in their pursuit of goals they have adopted**. Although there is much we might say about the processes themselves, our focus is primarily on assessment. For that reason, we present only those aspects of the relevant processes for which viable methods of assessment are available. In addition we consider the intrapersonal foundations on which these processes draw and the manifest consequences of success and failure at self-regulation. Before turning to the discussion of assessment strategies, including presentation of specific examples, we map the conceptual terrain within which these assessment strategies and exemplars are located.

The Conceptual Terrain

Self-regulation is complex. Its complexity arises from the collision of two complex entities. On one side is the person, with his/her unique set of endowments and proclivities and capable of symbolically projecting the self across time and location (both real and potential) and a remarkable diversity of goals and behaviors for pursuing them. On the other side are situations and settings, sufficiently varied that the person is unlikely to ever find him- or herself in the same set of circumstances twice. A model of self-regulation that can account for the virtually unlimited number of combinations of person and circumstance is neither attainable nor desirable. Rather, models that require relatively few constructs and arguments to account for most aspects of self-regulation are likely to be most useful. Drawing on various models of self-regulation and related constructs, we sketch a framework that will allow us to organize our review of specific strategies for assessing self-regulation.

Despite the large body of research on self-regulation and the current wave of interest in the construct, there is no widely acceptable model or framework that serves to integrate the many

relevant constructs and processes (Hoyle & Davisson, 2010). As shown in Figure 1, our framework situates these constructs and processes in three categories. The first we label *foundations*, by which we mean the intrapsychic resources on which self-regulatory processes draw. These might be considered the building blocks, or raw materials, of self-regulation. The second category, *processes*, encompasses those activities that qualify as self-regulation proper. The third category we have labeled *consequences*, by which we mean the fruits of self-regulation; the behavioral outcomes that serve as indicators of the degree to which self-regulation is routinely successful. Although variables in this category do not correspond to self-regulation per se, ultimately they are the outcomes that motivate an interest in understanding and cultivating skill at self-regulating behavior. In the remainder of this section, we provide fuller descriptions of these categories, highlighting the variables for which we present examples of specific strategies for assessment.

Foundations

Self-regulation is a complex mental process that draws on a set of basic capacities that are not specific to self-regulation but necessary for it. At the most basic level, these capacities involve brain activity; an example is working memory capacity. One step removed from *brain-related capacities*, and more directly implicated in processes of self-regulation, are basic dimensions of *temperament* and *personality*. A relevant dimension of temperament is inhibitory control; an example of a relevant personality dimension is impulsivity. Neither the relevant brain-related capacities nor the relevant dimensions of temperament and personality should themselves be considered self-regulation. Their influence on cognition, affect, and behavior is broad. Yet, they are essential for self-regulation, and therefore relevant to any discussion of self-regulatory deficits and skills. To use the language of a prominent model of self-regulation, they

are “resources” that are recruited when self-regulation is enacted (Muraven, Tice, & Baumeister, 1998).

The relevant brain-related capacities are, for the most part, captured by the term *executive function*, a set of cognitive processes and propensities that originate in the prefrontal cortex of the brain (Goldman-Rakic, 1987; for a review, see Best & Miller, 2010). Three core functions underlie the processes involved in most acts of self-regulation (Miyake et al., 2000). *Inhibition* involves stopping ongoing thoughts and actions either when prompted by an external signal or upon determining that continuation would lead to an error (Logan & Cowan, 1984). Because measures of inhibition are not pure (i.e., as discussed below, they often tap working memory as well), the location of brain activity associated with inhibition has not been clearly specified; however, the ventral prefrontal cortex is most often implicated beginning in adolescence (Best & Miller, 2010). *Working memory* involves keeping information active in primary memory while searching and retrieving information stored in secondary memory (Unsworth & Engle, 2007). Because keeping relevant information active while ignoring or suppressing competing information that is not relevant involves inhibition, inhibition and working memory are related. Complex tasks require the coordination of information relevant to multiple task components, requiring working memory to be flexible and controlled. From adolescence, working memory is associated with activity in the left dorsolateral prefrontal cortex and the anterior cingulate (Scherf, Sweeney, & Luna, 2006). Finally, *shifting* involves moving back and forth between mental states, rules, or tasks (Miyake et al., 2000). Although switching would appear to share qualities with inhibition, it differs in that shifting involves moving between mental sets that sometimes contains several task rules rather than stopping a single response as with inhibition (Crone, Somsen, Zanaolie, & Van der Molen, 2006). Given the complexity of shifting, it is not

surprising that multiple regions of the brain show increased activation during experimental tasks that require shifting. These include the anterior cingulate cortex and multiple regions in the prefrontal cortex, particularly those responsible for monitoring and detecting conflict (Best & Miller, 2010). The importance of these basic capacities is evident in a cornerstone of self-regulation, the delay of gratification, which requires the inhibition of an impulse to act in response to a temptation in the immediate environment in favor of one or more longer-term goals or priorities (Mischel et al., in press).

Variability in executive function initially expresses as individual differences in temperament, defined as “individual differences in emotional and motor reactivity and in the attentional capacities that support self-regulation” (Rothbart & Hwang, 2002, p. 113). Those capacities that support self-regulation generally serve to modulate emotional and motor reactivity (Rothbart & Bates, 2006). Principle among these capacities is *effortful control*, which involves inhibiting a dominant response in favor of a subdominant response, planning, and detecting errors. Referencing the brain-related activities described earlier, effortful control involves shifting attention and inhibiting behavior as needed. A related dimension of temperament is *reactive control*, which is the relatively involuntary influence of approach and avoidance motives. Of particular interest with regard to the emergence of self-regulation are the extreme forms of reactive control, over- and undercontrolled reactivity. Reactive undercontrol manifests as impulsivity, and reactive undercontrol is evident in avoidance tendencies as in shyness (Eisenberg, Eggum, Sallquist, & Edwards, 2010).

As the individual matures, temperament gives way to personality, tendencies of thought, feeling, and action that are moderately stable across the lifespan (increasingly so with increasing age; Roberts & DelVecchio, 2000). The number of constructs that might be classified as features

of personality is quite large. Generally, these constructs fall into one of two classes. Higher-order, or domain-level, personality constructs are the three, five, or seven (depending on the model and classification strategy) dimensions under which all personality traits can be gathered. The most prominent model of such dimensions is the five-factor model (and the similar big-five model), and the dimension most directly relevant for self-regulation is conscientiousness (referred to as constraint in another prominent model). *Conscientiousness* concerns the ways in which people characteristically manage their behavior. Individuals who are high on conscientiousness tend to be confident, disciplined, orderly, and planful (Costa & McCrae, 1992). In the five-factor model, domain-level constructs subsume sets of narrower, facet-level constructs. In the case of conscientiousness, the facets of orderliness, dutifulness, self-discipline, and deliberation reflect specific tendencies that serve the process of self-control.

Beyond higher-order personality constructs and their constituents is a potentially large number of narrower personality constructs that serve to facilitate or impede self-regulation. Principle among these is *impulsivity*, the tendency to act without thinking. In fact, it might be argued that impulsivity is the absence of self-regulation—behavior by impulse. Other lower-order personality constructs are relevant to self-regulation. Among the more interesting are those that concern self-regulatory style—how (rather than whether) self-regulation is accomplished. For instance, regulatory focus theory proposes two routes to self-regulation, prevention and promotion, and suggests that people differ in the route they customarily take (Higgins, 1998). Although these and other relevant personality traits offer relatively little in the way of explaining how self-regulation works, they predispose individuals to engage in routine patterns of thought, feeling, and action that either support or increase the challenge of self-regulating behavior.

Although relevant brain-related capacities, temperament, and personality should not be confused with the actual activity of self-regulation, they make it possible. They are foundational in their provision of the basic capacities and tendencies on which the processes involved directly in self-regulation draw. We now turn our attention to these processes.

Processes

There is no widely accepted model of the processes involved in self-regulation. Nevertheless, a relatively small number of stages in the self-regulation process suitable for our analysis can be distilled from several prominent models. Before describing those stages, we note an important distinction between models of self-regulation, highlighted in Figure 1. Some models concern self-regulation across time and situation in the pursuit of goals. These models generally are concerned with the pursuit of long-term goals that are of general personal significance to the individual. Karoly (2010) refers to self-regulation as described by these models as *type 1 self-regulation*. Examples include the pursuit of educational and vocational goals. These goals wax and wane in their salience and relevance to the individual. When situational factors render them salient, their pursuit is managed by *type 2 self-regulation*, which is temporally and situationally constrained. Type 2 self-regulation may be conscious or nonconscious. Nonconscious type 2 self-regulation is primed by goal-relevant stimuli in the immediate environment and operates without conscious awareness or effort (for a review, see Fitzsimons & Bargh, 2004). Conscious type 2 self-regulation involves self-awareness and deliberate effort (e.g., Carver & Scheier, 1981; Duval & Wicklund, 1972). Both forms of type 2 self-regulation serve to keep type 1 self-regulation on track.

The most fully drawn models of type 1 self-regulation are those developed for the purpose of describing effective learning strategies (e.g., Butler & Winne, 1995; Pintrich, 2000;

Zimmerman & Campillo, 2003). Self-regulated learners bring a variety of processes and behaviors to the task of acquiring new information and skills. Relevant processes and behaviors are arrayed in a three-phase outlined by Zimmerman and Campillo (2003). Self-regulation begins with *forethought*. During this phase of the process the individual sets goals and makes plans to achieve them based on an analysis of the task to be completed. The implementation of goals and plans is initiated when attention is focused on the goal and outcomes consistent with it and, importantly, the individual's beliefs that the goal can be achieved (i.e., self-efficacy regarding goal-relevant behaviors). Assuming a well-articulate goal, adequate planning, and motivation stemming from confidence the goal can be achieved, the individual transitions to the performance phase of the self-regulation process. *Performance* involves exercising self-control for the purpose of engaging in goal-relevant behaviors while avoiding behaviors irrelevant to or in conflict with the goal. A critical aspect of performance is self-observation, the metacognitive activity of monitoring behavior and its relation to goal pursuit. When an episode of goal-relevant behavior is completed, the self-regulating individual enters the final phase of self-regulation, self-reflection. During *self-reflection*, the individual evaluates his/her behavior as it relates to relevant goals and forms a reaction that serves to reward such behavior in the future or raise question regarding its effectiveness in pursuit of the goal. Evaluation and reaction form the basis for a re-examination of the goal and plans to achieve it when the individual re-engages the process for subsequent attempts at goal pursuit. The model assumes a cyclical process whereby the individual repeatedly moves from *forethought* to *performance* to *self-reflection*, realizing progress toward the goal with each successive cycle.

Models of type 2 self-regulation focus more narrowly on the immediate resolution of conflicts between ongoing goal pursuit and threats to the goal itself or to specific behaviors

relevant to it. Among the earliest formal models of the self-regulation process is Kanfer's (1970) three-component model, which posits an iterative feedback process by which the individual moves from a recognition that behavior change is needed to behavior that is consistent with the currently operative goal. The first stage of self-regulation, termed *self-monitoring*, is initiated when goal pursuit is disrupted (Duval & Wicklund, 1972; Kanfer & Hagerman, 1981).

Disruptions likely to prompt self-regulation are circumstances in which the next step in a behavioral sequence is unclear or when behaviors do not produce the expected consequences. Through self-monitoring the individual determines the source of the disruption and the course of action to be pursued in addressing it. *Self-evaluation* involves determining whether the current behavior is relevant to a goal of sufficient importance at the moment to warrant corrective actions and, if so, engagement in such actions. If the current behavior is deemed unimportant with reference to salient goals, then self-regulation terminates. Otherwise, the goal serves as a source of standards against which outcomes of behavior are measured (see also, Carver & Scheier, 1981). Successful self-regulation involves the alignment of current behavior and salient goal-related standards. The individual's response to the outcome of self-evaluation is *self-reinforcement*. Through self-reinforcement, the individual positively reinforces behaviors that maintain goal pursuit and negatively reinforces those that result in disruption or yield little or no convergence between behavior and goal-related standards in the face of disruption.

Type 2 models offer keen insights into the online processes by which situated behavior is monitored and adjusted to maintain the alignment of behavior and goals, they do not directly address the broader activity and concerns of type 1 self-regulation. As illustrated in the section to follow on assessment of self-regulatory processes, these models have served as the basis for models that align more closely with the more protracted process by which people remain on

course in their pursuit of goals. One such model extends Kanfer's (1970) model to the type 1 form of self-regulation, proposing seven steps in the process of self-regulation (Miller & Brown, 1991). In the first two steps, the individual receives relevant information and evaluates it with reference to personal standards and prevailing norms. In the remaining steps, the individual undertakes a change process through the formulation and implementation of a plan. The effectiveness of the plan is assessed and, as necessary, the process repeated. This process of self-regulation, if effective, yields observable progress toward personal and normative goals.

Consequences

A relatively unexplored aspect of self-regulation is its manifest consequences. What observable evidence is there that an individual is skilled or unskilled at self-regulation? As noted earlier, a portion of the goals to which self-regulation is applied are specific to the individual and, for that reason, the evidence of successful self-regulation will vary from one person to the next. Yet, a significant portion of the goals are shared, and therefore their successful pursuit would be evidence of skill at self-regulation for most, if not all, individuals. Examples include academic success as evidenced by regularly completing assignments as instructed and completing them on schedule; social success in the form of routine relationship maintenance behaviors; and good health as evidenced by proper diet and exercise and general avoidance of health-risk behaviors.

Another fertile category for assessment concerns evidence of success in the pursuit of goals routinely prescribed for specific individuals. For instance, hypertension patients often are prescribed a regimen that includes control of diet and regular intake of medications. Certain forms of psychotherapy might prescribe goals and behavioral evidence of their pursuit. In such

instances, self-regulation is necessary and evidence of successful self-regulation is concrete and specific.

Before presenting examples of assessment strategies corresponding to the categories in our organizational framework, we briefly touch on relevant approaches to assessment and desiderata of assessment in general and specific assessment strategies.

General Approaches to Assessment

Because of the broad range of constructs relevant for self-regulation and the need to assess them from infancy to late adulthood, a range of adaptable assessment strategies is needed. Before reviewing specific assessment strategies, we briefly describe three general approaches that capture most of the current approaches to assessing self-regulation and related constructs.

Self-Reports

The “work horse” of assessment is the self-report method. In the typical use of the self-report strategy, the respondent is given a set of statements and asked to select one of the provided response options to indicate extent of agreement or disagreement with the statement or the degree to which the statement accurately describes him/her. The statements typically reflect the construct of interest rather directly and, as such, the respondent is aware of what is being assessed. The response options often are numeric, defining points along a continuum anchored by extreme options (e.g., *strongly disagree*). Constructs rarely are assessed by single items; rather, they typically are reflected in a composite of self-ratings on multiple items. In the interest of internal consistency (an estimator of reliability), items in a set are often very similar in wording with the exception that a subset may be phrased so as to indicate less of the construct of interest (e.g., “I rarely arrive for meetings on time.”).

There are advantages and disadvantages to the self-report strategy for assessment. It typically is the least expensive approach to assessment in terms of materials as well as time and space requirements. In fact, in some cases, such assessments can be carried out via the Internet, thereby circumventing the need for paper documents and, in some cases, large spaces for staging the assessment. With regard to self-regulation and other intrapsychic constructs, the individual him- or herself would seem to be uniquely positioned to accurately report their standing on statements about the constructs. On the negative side, self-reports are subject to a number of biases that threaten their validity. Also, although people would seem to be in the best position to report on their own intrapsychic processes, they often do not have access to higher-order processes and therefore are unable to report about them accurately (Nisbett & Wilson, 1977). Finally, young children may lack the cognitive skills and reading ability to understand the statements they are asked to rate and the use of rating scales to do so.

Informant Reports

Informant reports share many of the qualities of self-reports. Indeed, a self-report instrument may be re-cast for informant reports either in addition to (as in collateral reports) or in lieu of self-reports. The informant report assessment strategy effectively addresses some of the limitations of the self-report strategy. Informant reports are free of self-referential biases that undermine the validity of self-reports. Well-trained informants who observe the target across time and situations may be able to infer and accurately report on characteristics of the target that the target is unable to accurately report about him- or herself. And the informant report strategy allows for assessment of pre-verbal children as well as individuals who for other reasons may be unable to read and understand the statements on which they are to be rated.

A drawback to the informant reporting method of assessment is the limited access most informants have to the individuals they are rating. For example, teachers only observe children in academic settings. Parents see them primarily in the home. And peers are privy to behavior only in selected settings. A somewhat expensive solution to this problem is the use of multiple informants, though the way in which ratings from multiple informants should be combined is not always clear (e.g., they do not always intercorrelate as might be expected). Even informants who regularly observe the individuals to be rated across time and situations might not be able to observe the characteristics of interest either because they are not readily observed (e.g., self-monitoring) or because they are embedded in complex behavioral sequences and therefore difficult to isolate (e.g., shifting).

Behavioral Task Performance

The need to isolate relevant constructs that typically occur in complex behavioral sequences is well served by controlled behavioral tasks that require only the capacity or skill of interest. These tasks are used most frequently to assess constructs in our foundations category; more specifically, those capacities that constitute executive function. Performance in terms of speed and efficiency in completing these tasks is assumed to measure strength of the focal capacities. Tasks are tailored to the age-group being assessed (examples are provided below). Generally, they do not require verbal skills or awareness by the individual of his/her use of the capacity. They typically are scored in terms of objective characteristics of performance (e.g., time to completion, number of mistakes). These qualities overcome many of the limitations of assessments by self- and informant reports.

These positive features of assessments based on behavioral task performance are offset somewhat by two shortcomings. Behavioral tasks tend to be tailored to the age-group being

assessed. Thus, any tracking of change in capacity over time is complicated by the fact that tasks, and therefore the basis of scores, changes. This concern lessens with increasing age and the possibility of using the same behavioral task repeatedly over time. A second shortcoming concerns the purity of capacities assessed by the tasks. Complex tasks (e.g., Tower of Hanoi, Wisconsin Card Sorting Task) likely require multiple, interdependent capacities, thereby producing scores that cannot be used to pinpoint standing on specific capacities (Garon, Bryson, & Smith, 2008).

Desirable Characteristics

Regardless of which method of assessment is used, the most desirable assessment strategies evidence a number of key characteristics. Foremost among these is construct validity, the degree to which variability in scores produced by the strategy corresponds to variability in individuals' true standing on the construct. In order for scores produced by an assessment strategy to be valid, they must be reliable; that is, they must be reproducible if produced by the same strategy on the same individuals under similar circumstances. Importantly, although reliability is a necessary condition for validity, it is not sufficient. An assessment strategy can generate highly reproducible scores that reflect constructs other than the intended construct, as with self-report measures that reliably capture social desirability and other biases.

Beyond these basic psychometric concerns are two more practical concerns related to the desirability of an assessment strategy. Ideally, the strategy can be adapted for use in the various conditions across which scores might be compared. For instance, as discussed with reference to behavioral tasks, the ideal strategy would be one that can be adapted for use across the age span. A second desirable characteristic of any strategy for assessing skill at self-regulating is a readily interpreted metric (Hoyle & Davisson, 2010). In the most likely case, this would involve

normative samples and a method for transforming raw scores to percentile ranks or *T* scores. Related to this concern is the value of an assessment strategy that allows for categorizing individuals to which it is applied in terms of skill level—for example, poor, normal, and exceptional. Strategies that can be used on the same individuals across time and situations and produce readily interpretable scores are the most likely to find their way from the research enterprise to the classroom and clinic.

Having defined self-regulation, proposed a framework within which the many constructs relevant to self-regulation can be organized, and discussed the characteristics of desirable assessment strategies, we are now in a position to consider specific assessment strategies.

Assessment of Foundations

Skill at self-regulating draws on a foundation of brain-related capacities that emerge in early childhood. Regularities in these capacities express as individual differences in temperament, which give rise to variability in personality traits that contribute to variability in skill at and style of self-regulating. In this section, we describe a number of measures in each of these foundational categories that warrant consideration in the development of a comprehensive battery for assessing skill at self-regulating.

Executive Function

Executive function concerns those brain-related capacities that make self-regulation possible. Although many different terms are used for the set of capacities referred to as executive function, most fall into one of three categories: inhibition, working memory, and shifting (Miyake et al., 2000). In the remainder of this section, we describe strategies for assessing one or more of these categories.

Behavioral inhibition and activation. Gray (1981) proposed a model of personality reflecting differences in the extent to which individuals are sensitive to varying reinforcing events. This model consists of two motivational systems: the behavioral inhibition system (BIS) and the behavioral activation system (BAS). The BIS is responsible for behavior in response to punishment and is related to anxiety and internalizing problems. The BAS is responsible for behavior in response to rewards and is associated with impulsivity and externalizing problems. There exist two key measures assessing dispositional BIS and BAS functioning: the BIS/BAS Scales (Carver & White, 1994) and the Sensitivity to Punishment/Sensitivity to Reward Questionnaire (Torrubia, Avila, Molto, & Caseras, 2001).

The BIS/BAS Scales (Carver & White, 1994) assess differences in personality that reflect varying sensitivity to regulatory systems. The 20-item measure consists of four subscales, one tapping sensitivity to the behavioral inhibition system (BIS) and three assessing sensitivity to the behavioral activation system (BAS):

1. The BIS (punishment sensitivity) scale, which assesses reactions to punishment (e.g., “I worry about making mistakes.”)
2. The Drive scale, which assesses pursuit of goals (e.g., “If I see a chance to get something I want, I move on it right away.”)
3. The Fun Seeking scale, which assesses desire for new rewards and tendency to approach rewards on the spur of the moment (e.g., “I often act on the spur of the moment.”)
4. The Reward Responsiveness Scale, which assesses responses to rewards (e.g., “When I see an opportunity for something I like, I get excited right away.”)

The internal consistency of the scales is adequate, ranging from .66 to .76. Recently, several researchers have modified the BIS/BAS scales for use in children and adolescents. In one

revision, individual items were adapted by simplifying the language for children (e.g., “I often act on the spur of the moment” changed to, “I often do things on the spur of the moment”) (Muris, Meesters, de Kanter, & Timmerman, 2005). This revision, referred to as the age-downward version of the BIS/BAS Scales, reported good internal consistency for both the BIS ($\alpha = .78$) and BAS scales ($\alpha = .81$) in a sample of 284 school-age children (8-12 years old). However, other researchers have successfully used the original BIS/BAS scales without modification in children as young as six years old (Coplan, Wilson, Frohlick, & Zelenski, 2006). The BIS/BAS scales have been used in studies that associate sensitivity to rewards with substance use (e.g., Brady, 2006). However, some research has found that the BIS/BAS Scales are unrelated to physiological measures of BIS/BAS activation (e.g., Brenner, Beauchaine, & Sylvers, 2005).

The Sensitivity to Punishment/Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001) also assesses individual differences in the BIS and BAS via sensitivity to punishment and sensitivity to reward, respectively. The 48-item measure consists of two subscales: sensitivity to punishment (e.g., “Are you often worried by things that you said or did?”) and sensitivity to reward (e.g., “Do you generally give preference to those activities that imply an immediate gain?”). The SPSRQ has been modified for use in children with the Caregiver Report of Child Punishment and Reward Sensitivity (Colder & O’Connor, 2004), which was adapted by eliminating items inappropriate for use with children, rewording other items to be more appropriate for child behavior, and by using a caregiver report in lieu of a self-report measure. The measure includes 34 items that can be divided into four subscales, similar to the Carver and White (1994) BIS/BAS Scales: (1) sensitivity to punishment (e.g., “Your child often refrains from doing something because of fear of being embarrassed.”), (2) impulsivity/fun-seeking (e.g.,

“Your child often has trouble resisting the temptation of doing forbidden things.”), (3) drive (e.g., “Your child likes to compete and do everything they can to win.”), and (4) reward responsivity (e.g., “The good prospect of obtaining a reward motivates your child strongly to do some things.”). The internal consistencies for each of the subscales are acceptable (α s range from .69 to .87); however, this revised measure is used infrequently.

Working memory capacity. Working memory capacity is typically thought of as the ability to store and process information at the same time (Salthouse, 1990). In contrast to what is generally thought of as short-term memory, working memory capacity predicts higher order cognitive skills, including reading skills (Daneman & Carpenter, 1980) and language learning (Baddeley, 2003). Recently, researchers have proposed that working memory capacity can be differentiated along two dimensions: contents and functions (Oberauer, Süß, Schulze, Wilhelm, & Wittmann, 2000). The content dimension can be divided into three categories: numerical, spatial-figural, and verbal working memory. Similarly, the functional dimension can also be divided into three categories: storage and transformation (i.e., storing information and transforming that information), supervision (i.e., monitoring and controlling mental operations and processes), and coordination (i.e., arrange individual pieces of information into larger information structures). Of particular interest to self-regulation research is the supervisory function of working memory capacity, which constitutes an executive function and is associated with prefrontal cortex processes such as goal-directed behavior (Duncan, Emslie, Williams, Johnson, & Freer, 1996).

Oberauer and colleagues (2000) review a series of 23 tasks aimed at assessing working memory capacity with reference to the functional and content distinctions outlined above. Here,

we present a selection of tasks assessing this executive function of working memory capacity (for a full listing of working memory tasks, see Oberauer et al., 2000).

Random generation. The random generation task (Baddeley, 1986) requires participants to produce a sequence of randomly selected keystrokes by using the number pad on a computer keyboard. Participants are instructed that the rhythm of their keystrokes must follow the beat of a visual flash shown on the screen every 800 ms. Participants are further instructed that the sequences produced must not be redundant. A typical random generation task contains three trials of 100 responses each. The random generation task has good internal consistency ($\alpha = .86$) and it has been used with success in children as young as 7 years old (Towse & McLachlan, 1999). This working memory capacity task is used to assess the supervisory or executive function of working memory because it requires participants to inhibit response and produce original sequences (Baddeley, 1996). Oberauer and colleagues (2000) note that although the random generation task primarily assesses the executive function (i.e., supervision), the task does require all three functions of working memory.

Star counting task. The star counting task (Das-Smaal, de Jong, & Koopmans, 1993) requires participants to count the stars in two rows on a computer screen from left to right. Interspersed throughout the rows of stars are plus and minus signs. When participants reached a plus sign, they were instructed to continue counting forward, and when they reached a minus sign, they were instructed to start counting backwards. After a particular number of items, the means of plus and minus are reversed. The dependent measure used is the time taken to count the stars. The star counting task has high internal consistency ($\alpha = .91$). This working memory task assesses attentional processes as controlled by the executive function, and is commonly used in research with children. The executive function is taxed in this task by asking participants to

switch between routines and to inhibit and change responses based on environmental cues. Performance on this task in children has been associated with reading comprehension and math skills (de Jong & Das-Smaal, 1995). This task maps onto the everyday expression of self-regulation quite well and is specifically used as an assessment of the ability to regulate one's attention.

Preschool Self-Regulation Assessment. The Preschool Self-Regulation Assessment (PSRA; Smith-Donald, Raver, Hayes, & Richardson, 2007) is a relatively new method of directly assessing self-regulation in young children (ages 2-5). The assessment evaluates three domains of self-regulation: emotional (i.e., the ability to manage and regulate one's emotions), attentional (i.e., ability to sustain, focus, and shift attention), and behavioral (i.e., resist impulses or comply with instructions). The PSRA consists of 10 behavioral tasks that are thought to assess children's self-regulation, in conjunction with an assessor report in which an assessor evaluates the child's emotions, attention, and behavior.

The assessor report of the PSRA was adapted from the Leiter-R social-emotional rating scale (Roid & Miller, 1997) and the Disruptive Behavior-Diagnostic Observation Schedule (Wakschlag et al., 2005). The total report has 28 items: 15 from the Leiter-R tapping activity level, attention, energy and feelings, impulse control, and sociability; 9 items from the DB-DOS assessing negative and positive affect, aggression, defiance, and noncompliance; an additional 2 items assessing anxiety. The 28 items on the scale load onto two factors: attention/impulse control and positive emotion. At this construct level, the scale has high internal consistency ($\alpha = .87$ for positive emotion; $\alpha = .89$ for attention/impulse control).

The behavioral tasks included in the PSRA are listed and briefly described in Table 1. An initial factor analysis of the behavioral tasks included in the PSRA yielded two factors, which 7

of the 10 tasks loaded on: impulse control (Snack Delay, Toy Wrap, Toy Wait) and compliance/executive control (Toy Sort, Tower Cleanup, Balance Beam, Pencil Tap). Smith-Donald and colleagues (2007) noted that the remaining three tasks were not included in factor analyses due to truncated range or binary responses. However, their small sample may have been a factor in the lack of variability on these tasks, so inclusion of these tasks in future uses of the PSRA is likely still warranted.

An initial study piloting the use of the PSRA in a low-income Head Start sample of preschoolers found that performance on PSRA tasks and assessor global ratings were associated with social competence, academic skills, and behavior problems. Specifically, attention/impulse control was negatively correlated with teacher-reported behavior problems and positively correlated with early math and verbal skills, as well as teacher-reported social competence. Likewise, compliance/executive control was negatively correlated with teacher-reported behavior problems and positively correlated with teacher reports of social competence. In addition, effective emotion regulation as measured by positive emotion was positively associated with early math and verbal skills. These findings demonstrate that the PSRA not only directly measures some consequences of effective self-regulation (e.g., compliance on the Tower Clean-Up, Toy Sort, and Toy Return tasks) but that it may be able to predict other consequences of effective self-regulation including social competence and academic skills.

Beyond its probable predictive value, the PSRA is a promising tool of assessing self-regulation in children for several reasons. First, the PSRA uses a multi-method approach to assessment by using both performance on behavioral tasks and global ratings of children's emotions, attention, and behavior via assessor ratings to evaluate self-regulation. The multi-method approach provides a richer picture of children's self-regulatory abilities and overcomes

some of the obstacles associated with using only one method of assessment (i.e., performance on behavioral tasks *or* assessor/caregiver ratings). In addition, the tasks on the PSRA use inexpensive materials (e.g., blocks, M&Ms), are brief, and are simple to administer with only brief training of assessors (Smith-Donald et al., 2007). Importantly, the behavioral tasks on the PSRA are derived from widely-used laboratory-based measures of self-regulation in young children (e.g., Murray & Kochanska, 2002) and demonstrate that such tasks can be implemented in applied settings with success across diverse samples (i.e., in Head Start programs).

Delay of gratification. Delay of gratification can be thought of as the ability to defer an immediate outcome or reward in favor of a preferred or more appealing outcome that requires one to wait in order to receive it. The ability to delay gratification early in life has been associated with a variety of positive outcomes, including higher SAT scores (Shoda, Mischel, & Peake, 1990), greater social competence, and more effective emotional coping skills (Mischel, Shoda, & Peake, 1988). Conversely, the relative inability to delay gratification has been associated with increased likelihood of being overweight in adolescence (Seeyave et al., 2009), among other negative outcomes. Typically, delay of gratification is assessed in children using behavioral measures in a laboratory setting (Mischel, Ebbesen, & Zeiss, 1972); the standard delay-waiting paradigm developed by Mischel and colleagues is used frequently in research with young children, school-age children, and adolescents. Although the delay-waiting paradigm is the most commonly used method of assessment, there are also a few self-report scales that measure delay of gratification.

Behavioral measures. Delay of gratification is most commonly assessed via a standard self-imposed delay-waiting paradigm (Mischel et al., 1972; Mischel et al., 1988). In a typical self-imposed delay study, children are presented with two objects that vary in appeal,

either of which they can obtain. They are told that they can have the less appealing of the two immediately or, if they are willing to forego the less appealing choice and wait, they can have the more appealing one. In one common version of this paradigm, children are offered either one marshmallow immediately or two marshmallows after waiting for some period of time (Mischel et al., 1972). Other versions of the delay-waiting paradigm vary the reward objects used; for example, two toys or foods differing in preference, a small candy bar and a large candy bar, or a small monetary reward and a larger monetary reward. When this measure of delay of gratification is used in older children, adolescents, and adults, the rewards are often monetary (e.g., \$7 vs. \$10) and the time period for delay is frequently lengthened (e.g., get paid \$7 now or \$10 in a week; Wulfert, Block, Santa Ana, Rodriguez, & Colman, 2002).

This assessment of delay of gratification has been used with success in children as young as four years old. As noted earlier, longer self-imposed delays on the standard delay of gratification paradigm have been linked with academic and social competence, effective coping skills, and a decreased likelihood of negative outcomes including becoming overweight and substance use. In addition, longer self-imposed delays were associated with positive personality traits, including greater planfulness and attentiveness—both of which are thought to be meaningful components of the ability to self-regulate successfully (Shoda et al., 1990). Importantly, the studies that report these connections between the ability to defer gratification and positive outcomes have generally predicted these outcomes from children's delay of gratification at four or five years old. By using behavioral measures (as opposed to typical self-report measures of personality), researchers examining delay of gratification have been able to predict adolescent (and even adulthood) behavioral outcomes and advantageous personality traits from a very young age.

Self-report measures. Delay of gratification is one area of research and assessment in which behavioral measures trump self-report measures. The standard self-imposed delay-waiting paradigm is used so widely—and with such success in predicting behavioral outcomes—that self-report measures of delay of gratification are quite lacking compared to other constructs we mention. One self-report measure, the Multidimensional Work Ethic Profile (MWEP; Miller, Woehr, & Hudspeth, 2001), has a delay of gratification subscale that assesses one's willingness to postpone rewards. The delay of gratification subscale consists of 7 items (e.g., "A distant reward is usually more satisfying than an immediate one) and possesses adequate internal consistency (α s range from .77 to .81). Initial correlational studies using the measure found that delay of gratification was significantly correlated with conscientiousness, achievement, job satisfaction, and job involvement (Miller et al., 2001). However, this measure has been used primarily with young adults and adults in vocational research and would need to be reworded for use with children.

Within educational psychology, a self-report measure of academic delay of gratification has been developed. The Academic Delay of Gratification Scale (ADOGS; Bembenuddy & Karabenick, 1998) assesses delay of gratification in an academic context; specifically, the scale assesses students' willingness to defer immediate opportunities in favor of their academic goals. The scale consists of 10 items that present students with two options and instructs them to choose one of the options (e.g., "Study a little every day for an exam in this course and spend less time with your friends OR spend more time with your friends and cram just before the test"). The ADOGS has adequate internal consistency ($\alpha = .70$) and the simple wording makes it appropriate for use in school-age children as well as adolescents and college students. However, this scale has primarily been used in research with older adolescents and college students and has not been

used widely to predict longer-term academic or career success outcomes. Despite its limited use, the ADOGS is noteworthy because, although it is a self-report measure, the items conceptually map onto the behavioral measures used to assess delay of gratification. Moreover, the ADOGS examines a particular domain of delay of gratification (academic), in line with some research that has suggested that delay of gratification may be, in part, domain-specific (Ward, Perry, Woltz, & Doolin, 1989).

Temperament and Personality

Regularities in brain-related capacities manifest early in life as temperament then, as adolescence approaches, personality. As with executive function, temperament and personality are foundational to skill at self-regulating. In the remainder of this section, we review a noteworthy subset of the many measures of temperament and personality characteristics relevant for self-regulation.

Impulsivity. Impulsivity is the tendency to act without forethought or planning. Impulsive behaviors are frequently risky in nature; impulsivity has been associated with a variety of problem behaviors, including alcohol use, drug use, sexual risk-taking, and aggression. There exist a wide variety of ways to assess impulsivity, however, there is not one measure that is consistently used more than others. Despite the lack of consensus, some measures are used quite frequently and show promise in predicting behavior in children, adolescents, and adults. The most commonly used measures of impulsivity can be separated into three main categories: self-report measures, behavioral measures, and caregiver or teacher ratings.

Self-report measures. The Barratt Impulsiveness Scale-11 (BIS-11; Patton, Stanford, & Barratt, 1995) is a 30-item self-report measure of impulsivity, composed of three subscales: attentional impulsiveness (e.g., “I don’t pay attention”), motor impulsiveness (e.g., “I

act on the spur of the moment”), and non-planning impulsiveness (e.g., “I say things without thinking”). A recent large-scale study ($N = 1577$; Stanford et al., 2009) demonstrated that the BIS-11 has good internal consistency ($\alpha = .83$) and established normative scoring cutoffs for over-control, normal impulsiveness, and high impulsiveness ($< 52 =$ over-control or dishonest completion; $52-71 =$ normal impulsiveness; $\geq 72 =$ high impulsiveness). However, many of the items on the scale would not be appropriate for use with children or adolescents (e.g., “I change residences,” “I change jobs”). An adolescent version of the scale (BIS-11-A) was developed by rewording 15 of the 30 items (e.g., “I change jobs” reworded to, “I change my mind about what I will do when I grow up” and “I change residences” reworded to, “I change friends”; Fossati, Barratt, Acquarini, & di Ceglie, 2002). The adolescent version of the scale demonstrates satisfactory internal consistency ($\alpha = .78$). The BIS-11-A has been used to examine the relationship between impulsivity and substance use in adolescent samples (e.g., von Diemen, Bassani, Fuchs, Szobot, & Pechansky, 2008) but has not been widely used thus far, especially in the United States.

The I_6 Impulsiveness Questionnaire is a self-report measure of impulsivity that comprises three subfactors: impulsiveness, venturesomeness, and empathy. The I_6 was adapted for use in children with the Junior I_6 (Eysenck, Easting, & Pearson, 1984). The Junior I_6 is a 69-item measure that includes 23 items tapping each of the three subfactors (i.e., impulsiveness, venturesomeness, and empathy). The scale asks children to read each question and indicate whether they are true of them or not on a yes/no scale. Example items from the impulsiveness subscale include, “Do you generally do and say things without stopping to think?” and “Do you think that planning takes the fun out of things?” The impulsiveness scale demonstrates acceptable internal consistency across samples of boys and girls ages 8-15 (α s range from .74 to

.83; Eysenck et al., 1984). Although the Junior I₆ is typically used with older children, the simple wording and dichotomous response options suggest that it may be suitable for use in younger children.

Dickman's (1990) Impulsivity Inventory is a self-report measure that assesses functional and dysfunctional impulsivity. The scale consists of 11 items tapping functional impulsivity (e.g., "I would enjoy working at a job that required me to make a lot of split-second decisions") and 12 items assessing dysfunctional impulsivity (e.g., "I often say and do things without considering the consequences"); the response scale is yes/no. This inventory makes an important distinction between forms of impulsivity that may lead to success in life (e.g., the ability to think on one's feet) and forms of impulsivity that may lead to problematic behaviors and risk-taking (e.g., not fully considering the consequences of one's behavior). This measure has been modified for use in children (Brunas-Wagstaff, Tilley, Verity, Ford, & Thompson, 1997). The Functional and Dysfunctional Scale for Children (Brunas-Wagstaff et al., 1997) comprises 10 items assessing functional impulsivity (e.g., "If my friend asks me to go out I like to think about it. I don't like to say 'yes' or 'no' right away") and 10 items tapping dysfunctional impulsivity (e.g., "If someone gave me a present before my birthday I would save it until my birthday to open"). The items are reworded to be appropriate for use in children, and the response scale is changed to "like me"/"not like me." The dysfunctional subscale demonstrates adequate internal consistency (α s range from .63 to .73), but the functional subscale does not, especially in younger children. The authors of the scale attribute the lack of internal consistency for functional impulsivity to the fact that this facet of impulsivity may not emerge until later in life, due to further opportunities to use functional impulsivity as people age. Therefore, this scale is probably not appropriate for use

in young children, but may be useful in distinguishing among forms of impulsivity in adolescents.

Behavioral measures. The stop-signal task (Logan, Schachar, & Tannock, 1997) is thought to be a behavioral measure of impulsivity. Participants are instructed to respond as quickly as possible when a particular letter (go signal) appears on a computer screen by pressing an assigned key. Participants are also instructed to inhibit their response in the presence of a tone (stop signal). The typical dependent measures used with the stop signal task are mean reaction time to the go task, proportion of correct responses, mean reaction time to the stop signal, proportion of correct responses, and the probability of responding given a stop signal. Performance on this task is strongly correlated with impulsive behavior. The stop-signal task has been modified for use with children using shapes (e.g., Mickey Mouse, smiley faces) and colors and has been used with children as young as 4 years old (Pasalich, Livesey, & Livesey, 2010).

The Go/No-Go task (Newman, Widom, & Nathan, 1985) is a learning task that assesses impulsivity via response inhibition. In this task, participants are presented with eight two-digit numbers, four of which are “correct” and four of which are designated “incorrect.” Participants are instructed to respond when “correct” numbers are presented and to inhibit responses when “incorrect” numbers are presented. Participants typically receive small monetary rewards (e.g., \$0.05) for correct responses and are penalized similarly for incorrect responses. The typical dependent measure of impulsivity with the Go/No-Go task is errors of commission (i.e., responses to “incorrect” numbers). The Go/No-Go task has been adapted for use in children using pictures instead of numbers; however, some research suggests that the task is not suitable for use in children younger than 4.5 years old (Akshoomoff, 2002).

The Matching Familiar Figures Task (MFFT; Kagan, 1966) is a behavioral measure frequently used to assess impulsivity in children. Children are presented with 12 sets of target figures and six variants of each target, and then asked to point to the identical variant. In this task, mean reaction time is used as a dependent measure of impulsivity, with shorter reaction times indicating greater impulsivity. Impulsivity as measured by the MFFT has been associated with being overweight in school-age children (Braet, Claus, Verbeken, & Van Vlierberghe, 2007) and bulimia in adolescents and young adults (Kemps & Wildson, 2010), among other problematic outcomes.

Caregiver or teacher ratings. The Children's Behavior Questionnaire (CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001) is a 195-item caregiver report measure that assesses temperament in children aged 3 to 8 years. The CBQ consists of 15 scales assessing different temperament characteristics, including impulsivity. Parents are asked to read each item and decide whether the statement is true of their child's responses in the past six months on a 1 (*extremely untrue*) to 7 (*extremely true*) scale. The Impulsivity subscale assesses what the authors of the scale term "speed of response initiation" (e.g., "Usually rushes into an activity without thinking about it"). A review of studies using the CBQ revealed that the impulsivity subscale demonstrates adequate internal consistency (α s ranged from .74 to .78). Moreover, the CBQ is used widely in developmental research; a search of the reference in the PsycINFO database returns 332 results. Additionally, the CBQ has been translated into and adapted for use in 15 different languages, including Arabic, Chinese, and Spanish.

The Teacher-Reported Impulsivity Scale (TRIS; White, Moffitt, Caspi, Bartusch, Needles, & Stouthamer-Loeber, 1994) is a 6-item scale adapted from items appearing on the Self-Report Delinquency Scale (Elliot et al., 1985) and the Child Behavior Checklist (Achenbach

& Edelbrock, 1983). Teachers are asked to rate the degree to which each of the items is true of a particular student on a 0 (*not at all true*) to 2 (*very/often true*) scale. Example items include “acts without thinking” and “talks out of turn.” The initial implementation of the measure demonstrated good internal consistency ($\alpha = .90$). Although this measure was originally developed for use with pre-adolescents and adolescents (10-13 year olds), it has been used recently with success in children as young as 5 years old (Gomes & Livesey, 2008).

Conscientiousness. Conscientiousness generally concerns the ways in which people characteristically manage their behavior. People who are high on conscientiousness are confident, disciplined, orderly, and planful, whereas people who are low on conscientiousness are not confident in their ability to control their behavior, spontaneous, distractible, and prone to procrastinate (Costa & McCrae, 1992). The most widely used measure of conscientiousness is the Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1992), a 240-item self-report measure, which assesses five broad dimensions of personality, including conscientiousness, and six facets of each.

A recently developed measure, the M5-PS (Grist & McCord, 2010) aims to assess conscientiousness in preschool-age children. This measure is rooted in the five-factor model of personality and the items are derived from the NEO-PI-R (Costa & McCrae, 1992). The M5-PS consists of 90 items, with 18 items tapping each of the five factors. The measure is a caregiver/teacher rating style, with all items in the third person, and caregivers or teachers asked to rate whether the items describe the child on 1 (*very inaccurate*) to 5 (*very accurate*) scale. Sample items on the conscientiousness subscale include “completes tasks successfully” and “breaks rules.” An initial study using the measure revealed that the conscientiousness subscale had high internal consistency ($\alpha = .88$). Although this new measure has yet to be used with any

frequency, its theoretical grounding in the Five Factor Model and its development from the widely-used NEO-PI-R suggest that it will likely be used commonly in the future. The widespread use of the NEO-PI-R in predicting positive and negative behaviors alike (e.g., Bogg & Roberts, 2004) suggests that M5-PS may be a promising measure to use in the prediction of self-regulatory behavior from personality during childhood.

Assessment of Processes

Selected aspects of executive function, temperament, and personality provide the raw materials on which the individual draws to enact self-regulation. Unlike these foundational properties, for which an array of assessment strategies are available, relatively few options are available for assessing skill at the actual process of self-regulating. In fact, in this section we describe a single self-report measure that purports to cover the full range of activity involved in type 1 self-regulation.

Self-Regulation Questionnaire

The Self-Regulation Questionnaire (SRQ; Brown, Miller, & Lawendowski, 1999) is a 63-item self-report assessment of self-regulatory abilities based on Miller and Brown's (1991) seven-step model of self-regulation. In this model, self-regulation is viewed as the ability to establish, execute, and sustain planned behavior in the service of attaining one's goals. The SRQ asks individuals to report on their abilities to execute each of seven sub-processes necessary for behavioral self-regulation:

1. Receiving relevant information (e.g., "I usually keep track of my progress toward my goals")
2. Evaluating information and comparing to norms (e.g., "I have personal standards, and try to live up to them")

3. Triggering change (e.g., “I am willing to consider other ways of doing things”)
4. Searching for options (e.g., “I have sought out advice or information about changing”)
5. Formulating a plan (e.g., “Once I have a goal, I can usually plan how to reach it”)
6. Implementing the plan (e.g., “I get easily distracted from my plans”)
7. Assessing the effectiveness of the plan (e.g., “I don’t seem to learn from my mistakes”).

All items are answered on a 1 (*strongly disagree*) to 5 (*strongly agree*) scale. The SRQ is internally consistent ($\alpha = .91$) and has high test-retest reliability. The total score of the SRQ is interpreted with reference to self-regulatory functioning and normative scoring cutoffs have been established (≥ 239 = high self-regulation capacity, 214-238 = moderate self-regulation capacity, ≤ 213 = low self-regulation capacity), making it one of the few assessment tools that might be used to differentiate individuals in terms of level of skill at self-regulating.

Self-regulatory functioning, as assessed by total scores on the SRQ, has been associated with a number of outcomes consequential for personal well-being. Because this model was initially developed to examine addictive behaviors, the majority of studies that make use of the SRQ have examined its relationship with substance use and addictive behaviors. For instance, two studies with college students demonstrated that lower scores on the SRQ (i.e., low self-regulation capacity) were associated with binge drinking, negative alcohol-related consequences (e.g., relationship problems, injury), marijuana use, risk-taking, impulsivity, tobacco use, and driving under the influence (Brown, Baumann, Smith, & Etheridge, 1997).

As an assessment of self-regulatory functioning, the SRQ has not yet enjoyed widespread use outside of studies examining substance use and other risky behaviors in college students or in samples of people with addictive disorders. However, because the majority of items are not worded with reference to events or situations specific to young adults or older, there exists the

possibility of modifying the scale for use with children and adolescents. Importantly, because this assessment of individuals' ability to enact various self-regulatory processes is associated with the incidence of risky and addictive behaviors, it likely has merit as a predictive tool of those same behaviors. Existing normative scoring cutoffs provide ease of interpretation, especially as compared to most ad-hoc measures of self-regulation. Future work should attempt to revise this measure for use with children and adolescents, and would do well to implement the existing measure in studies of other types of behavioral outcomes associated with one's ability to self-regulate effectively (e.g., dieting, academic outcomes).

Assessment of Outcomes

A relatively unexplored approach to assessing skill at self-regulating is to focus on concrete and observable behavioral outcomes that ordinarily would result primarily from successful self-regulation. Such measures get at the “bottom line” of self-regulation—the degree to which individuals are successfully pursuing and achieving adaptive goals. We offer recent examples of assessment strategies that at least include a component focused on outcomes; however, at this point in time, there is no measure or assessment strategies focused exclusively on outcomes reflective of skilled self-regulation.

Behavioral Indicators of Conscientiousness

The Behavioral Indicators of Conscientiousness (BIC; Jackson, Wood, Bogg, Walton, Harms, & Roberts, 2010) is a recent measure that demonstrates previously untapped potential for better linking personality traits associated with successful self-regulation by focusing on the behavioral outcomes associated with those traits. This measure consists of 185 items tapping 11 behavioral factors associated with conscientiousness, plus general conscientiousness:

1. Avoid work—e.g., “Play sick to avoid doing something”

2. Organization—e.g., “Make a grocery list before going to the store”
3. Impulsivity—e.g., “Buy something on the spur of the moment”
4. Antisocial—e.g., “Lie to authority figures”
5. Cleanliness—e.g., “Clean the inside of the microwave oven”
6. Industriousness—e.g., “Work or study on a Friday or Saturday evening”
7. Laziness—e.g., “Bypass a difficult task”
8. Appearance—e.g., “Clean up right after company leaves”
9. Punctuality—e.g., “Allow extra time for getting lost when going to new places”
10. Formality—e.g., “Sit with a straight back”
11. Responsibility—e.g., “Hold the door for people”
12. General conscientiousness—e.g., “Fulfill an obligation to someone”

This measure is noteworthy because it translates markers of conscientiousness into a self-report scale of everyday behaviors that people should find easy to report. In an initial study, the reliability of the measure was good ($\alpha = .92$). However, because this measure is so new, there are no current data on its reliability or use in samples other than college students. This type of measure may show promise for the assessment of personality markers of self-regulation in children, though, as children may find it easier to report on everyday behaviors than abstract concepts.

Other Examples

We are aware of no other contemporary measures relevant to self-regulation that focus specifically on behavioral evidence of skill at self-regulating behavior. In one of the earliest examples of empirical research on self-regulation, Thorne (1946) described work aimed at developing “objective methods of estimating the degree of self-control, conscious volition, and

rational utilization of resources of which any person is capable” (p. 375). He produced a “diagnostic outline” designed to determine “the degree of self-control habitually shown by a person” (p. 376). Examples of the 30 behaviors included in the outline are regularly adhering to a work schedule, showing decisiveness, resisting distractions, and temperance. Although the list and behavioral descriptions are dated, Thorne’s outline exemplifies an assessment strategy focused on behavioral evidence of skill at self-regulating.

Otherwise, specific behavioral outcomes are sometimes embedded in measures of foundations or process. For example, among the 10 tasks that compose the Preschool Self-Regulation Assessment (Smith-Donald et al., 2007) are several that concern the type of behavioral outcomes to which we refer. After completing the Tower Task (Murray et al., 2002), the child is asked to clean up the blocks used for the task; self-regulation is indexed by the time to completing clean-up. In other behavioral tasks, the child is asked to sort and put away toys without playing with them (Brumfeld & Roberts, 1998) and return a fun toy after a period of play (NICHD, 1998); again self-regulation is assessed by the amount of time required to complete the behavior. Although these behaviors are not the same as self-generated behavior in the course of everyday life, they approximate the types of behavioral outcomes that we believe offer concrete, behavioral evidence of skill at self-regulating. Exploration of the use of analogous tasks for adolescents and adults (e.g., latency to closing an engaging computer program when asked) seems warranted.

Prospects

The conceptual terrain covered by self-regulation and the broad array of behaviors for which self-regulation is potentially relevant establish its importance while presenting significant assessment challenges. In the first decade of the 21st century, self-regulation has been among the

most studied self-referent processes, converging on established constructs such as self-concept and self-esteem in terms of number of published research articles. Although the empirical evidence suggests that this attention is warranted, it has not yet addressed to a satisfactory degree several critical concerns regarding the self-regulation construct. The most fundamental of these is precisely what constitutes self-regulation; that is, what is it and what is it not? A related concern, which is the focus of this paper, is how self-regulation should be assessed. It seems unlikely that quality of assessment will ever exceed the clarity and precision of models of the construct. Nonetheless, assessment efforts have yielded significant advances, most within the most recent five years.

Current State of Self-Regulation Assessment

The state of self-regulation assessment at the end of the first decade of the 21st century is preliminary. If what we have deemed foundations are excluded, the state of assessment hardly approaches preliminary, consisting of a small number of ad hoc measures for which there is neither strong evidence of validity nor normative data that would allow the classification of people in terms of their skill at self-regulating.

The best measures relevant to the self-regulation are those that assess foundations. Executive function continues as a core focus of research in developmental and cognitive psychology. Although many measures used in this research were designed and have been validated in the research context, some are finding their way into assessment tools for use in applied settings (e.g., the Preschool Self-Regulation Assessment; Smith-Donald et al., 2007). Measures of relevant personality constructs such as conscientiousness and impulsivity have a relatively long history and, though normative data are rare, have well-established reliability and validity. To summarize, the assessment of precursors to self-regulation is, in many respects,

promising; however, the assessment of self-regulation, either the process itself or the behavioral outcomes it produces, is not yet sufficiently developed to judge whether current efforts hold promise for eventual export from research to applied settings.

Next Steps

In our view, the future of assessment of skill at self-regulating hinges on the development of a clear, parsimonious, and widely-accepted articulation of the construct. We have offered a preliminary framework; however, it is more a starting point than a definitive contribution. The most profitable focus of such efforts would be on the process of self-regulation, with a particular focus on type 1 self-regulation (which has received relatively little attention among researchers compared to type 2 self-regulation). With a clearly articulated process in place, then variables such as those in our foundations category could be more readily identified and, importantly, linked to specific aspects of the self-regulation process. Although such information is not essential for the development of measures that fall into our outcomes category, it would no doubt suggest behavioral outcomes that best reflect skill at self-regulating versus those that most likely are attributable to other processes.

Challenges

Despite the preliminary state of current models of and assessment strategies for self-regulation, it is now evident that skill at self-regulating is critical to productivity and success across multiple life domains (e.g., Caspi et al., 1997; Heckman, 2006; Lindqvist & Vestman, 2011; Mischel et al., 1988). For this reason, self-regulation warrants continued attention both in terms of conceptualization and assessment. In order to realize progress toward a useful conceptual model and effective assessment strategies, a number of key challenges must be met.

Better Delineating the Construct

The first challenge is to settle on a model and its key components. Elsewhere, we have noted the lack of consistency in definitions of self-regulation and related constructs (Hoyle & Davison, 2010). A sufficient number of relevant studies have now accumulated that it should be possible to integrate findings and outline the critical features of the self-regulation construct. A key consideration for such an effort will be establishing what self-regulation is *not*. For example, the constructs in our foundations category often are referred to as self-regulation (e.g., the *Preschool Self-Regulation Assessment*), but they are relevant to processes other than self-regulation. Moreover, despite their necessity for self-regulation, variability in capacity of foundational constructs does not correspond directly to variability in self-regulation. For instance, significant increases in brain-related capacities during early childhood development generally are not accompanied by commensurate increases in skill at self-regulating (Best & Miller, 2010).

A definitional matter that, to our knowledge, is not discussed in the literature on self-regulation concerns the degree to which the behavioral outcomes of successful self-regulation are always positive. As we (and most scholars) have defined it, self-regulation is the means by which people effectively pursue their goals. Of course, not all goals are positive or constructive. One might argue for instance, that the most successful criminals are skilled at self-regulating; they are deliberate, planful, capable of juggling multiple tasks and making adjustments as needed. What seems necessary for self-regulation to produce adaptive and productive outcomes is goals consistent with those outcomes. Further developments in the definition of self-regulation should address this concern, and assessment efforts focused on adaptive and productive outcomes should ensure that this additional element is part of the assessment protocol.

Improving Assessment

Virtually all of the assessment strategies for self-regulation and related constructs have been developed by researchers. These strategies have proven useful in research settings; however, they generally are not suitable for skills assessment. What is needed are rigorous research efforts focused specifically on the assessment of skill at self-regulating for purposes of diagnosis and classification. The desirable characteristics of such assessments were outlined earlier. It bears repeating, however, that the most useful assessment strategies will yield scores that are readily interpreted and useful for distinguishing individuals who lack adequate skills from those individuals whose skills are adequate or exemplary. Given the nature of extant measures and those likely to be developed, the best route to ensuring such scores would be to establish population norms, stratified as necessary to ensure that normative scores account for extraneous influences related to gender, race/ethnicity, culture and the like.

Summary and Conclusions

A significant portion of human behavior is potentially under the control of the individual. Variability in whether people choose to exercise control over their behavior and the degree to which they are capable of so doing explains, at least in part, a wide array of behaviors. These include problem behaviors that presumably arise when maladaptive impulses and situational pressures are not overcome, and productive behaviors that are achieved only through deliberate and planful regulation of goal pursuit. With the import of self-regulation now well-established, the time is ripe for the development of high quality assessment strategies that allow interested parties to establish the degree of skill at self-regulating evident for a given individual, track changes in skill level over time, and document changes in skill level as a result of interventions and programs designed to improve it.

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Table 1

Tasks in the Preschool Self-Regulation Assessment

Task	Description	Dependent Measure
Toy Wrap (Murray & Kochanska, 2002)	Child asked not to peek while “assessor” wrapped toy	Latency to first peek
Toy Wait (Murray & Kochanska, 2002)	Child asked to wait without touching wrapped toy	Latency to touch toy
Snack Delay (Murray & Kochanska, 2002)	Child asked to wait for signal before finding M&M under a clear cup	Level of waiting (1-4)
Tongue Task (Murray & Kochanska, 2002)	Child and assessor wait with M&M on tongues and see who will eat it first	Latency to eat M&M
Balance Beam (Maccoby et al., 1965)	After walking line once, child asked to walk same line slowly	Difference between regular and slow trials
Tower Task (Murray & Kochanska, 2002)	Child asked to take turns with assessor building a tower of blocks	Level of turn-sharing (0-1)
Pencil Tap (Diamond & Taylor, 1996)	Child instructed to tap pencil once when assessor tapped twice and tap twice when assessor tapped once	Percent of correct responses
Tower Clean-up (Brumfeld & Roberts, 1998)	Child asked to clean up blocks from Tower Task	Latency to complete clean-up
Toy Sort (Brumfeld & Roberts, 1998)	Child instructed to sort and put away toys without playing with them	Latency to complete clean-up
Toy Return (NICHD, 1998)	Child instructed to return fun toy after period of play	Latency to return toy

Foundations	Processes	Consequences
<ul style="list-style-type: none"> ➤ executive function <ul style="list-style-type: none"> • inhibition • working memory • shifting ➤ temperament <ul style="list-style-type: none"> • effortful control • reactive control ➤ personality <ul style="list-style-type: none"> • higher-order • lower-order 	<ul style="list-style-type: none"> ➤ type 1 <ul style="list-style-type: none"> • forethought • performance • self-reflection ➤ type 2 <ul style="list-style-type: none"> • self-monitoring • self-evaluation • self-reinforcement 	<ul style="list-style-type: none"> ➤ normative ➤ domain specific ➤ idiosyncratic

Figure 1. Organizational framework for areas of assessment related to self-regulation.