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Self-Control and Academic Achievement

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Keywords

self-control, academic achievement, noncognitive, motivation, learning, self-regulation

Abstract

Self-control refers to the alignment of thoughts, feelings, and actions with enduringly valued goals in the face of momentarily more alluring alternatives. In this review, we examine the role of self-control in academic achievement. We begin by defining self-control and distinguishing it from related constructs. Next, we summarize evidence that nearly all students experience conflict between academic goals that they value in the long run and nonacademic goals that they find more gratifying in the moment. We then turn to longitudinal evidence relating self-control to academic attainment, course grades, and performance on standardized achievement tests. We use the process model of self-control to illustrate how impulses are generated and regulated, emphasizing opportunities for students to deliberately strengthen impulses that are congruent with, and dampen impulses that are incongruent with, academic goals. Finally, we conclude with future directions for both science and practice.

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Self-control: the alignment of thoughts, feelings, and actions with enduringly valued goals in the face of momentarily more alluring alternatives

Self-regulated learning: motivational, volitional, and learning processes that collectively contribute to students becoming independent learners

Impulse: a response tendency that is either desirable or undesirable and that is discharged (as a thought, emotion, or action) when of sufficient strength

SELF-CONTROL AND ACADEMIC ACHIEVEMENT

Teachers have long held that self-control is necessary for academic achievement (Dewey 1938). In recent decades, our understanding of the mechanisms underlying self-control has advanced well beyond early descriptions of will (Webb 1915). What have we learned about self-control and academic achievement? To answer this question, we begin by defining self-control and distinguishing it from related constructs, including conscientiousness, self-regulated learning, and compliance with authority. Next, we explain why self-control is particularly relevant to carrying out the diverse tasks of what Corno & Mandinach (2004) call studenting. We then turn to evidence that more self-controlled students thrive academically at every level of formal schooling, from kindergarten through university. Using the process model of self-control (Duckworth et al. 2014), we explain how impulses of any kind are generated in a recursive cycle that includes four stages: situation, attention, appraisal, and response. We summarize empirical evidence suggesting that self-control entails deploying strategic maneuvers either to strengthen impulses that are congruent with academic goals or to weaken competing impulses. Last, we suggest especially promising directions for future research and practice.

DEFINING SELF-CONTROL

We define self-control as the self-initiated regulation of thoughts, feelings, and actions when enduringly valued goals conflict with momentarily more gratifying goals. To illustrate this, consider the example shown in **Figure 1*a***, in which a student faces a self-control conflict when choosing between studying for a math test and scrolling through new photos in their Instagram feed. Scrolling through Instagram is extremely fun in the moment but not valued in the long run. In contrast, studying for the math test is not very fun in the moment but valued in the long run,

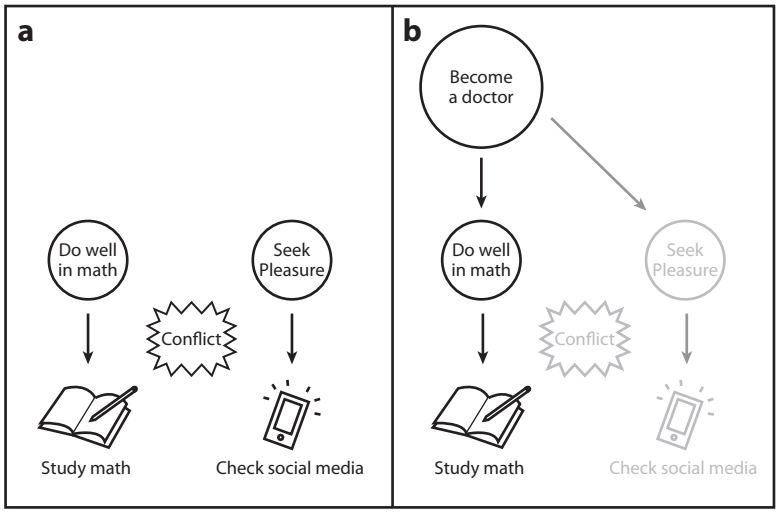

Figure 1

(*a*) Studying math and checking social media are mutually exclusive responses. Studying is congruent with the academic goal of doing well in math, whereas checking social media is congruent with the goal of immediate pleasure. (*b*) Doing well in math is related to the student's goal of becoming a doctor, whereas pleasure is primarily an end in itself. Self-control thus takes the form of enacting the impulse to study math while refraining from the impulse to check social media.

particularly because, as indicated in **Figure 1*b***, this student dreams of becoming a doctor someday. Because the student cannot do both at once, they exert self-control in **Figure 1*b*** when they choose the academic goal–congruent (AGC) response rather than the academic goal–incongruent (AGI) response.

Given its popularity as an object of study, it is not surprising that self-control research suffers from the so-called jingle jangle problem identified by Kelley (1927) as an impediment to scientific progress. The jingle problem arises because the term self-control is defined differently across research traditions (Duckworth & Kern 2011). For example, self-control has been characterized in the classical philosophical and psychological literatures as effortful suppression of impulses [Freud 1977 (1916–1917), Plato 1995 (370 BCE)], but it can also refer to more strategic tactics for obviating goal conflict (Duckworth et al. 2016a, Hofmann & Kotabe 2012). The jangle problem arises when different terms are used to refer to the same underlying construct. Terms that have been used more or less interchangeably with self-control include delay of gratification, effortful control, inhibitory control, and cognitive control. Terms for the absence of self-control include delay discounting, impulsivity, and impulsiveness.

Exacerbating this semantic confusion, several constructs overlap with self-control but are broader in scope. Most relevant to this review, the term self-regulated learning encompasses all of the psychological processes that contribute to students becoming independent learners (Zimmerman 1990). Self-regulated learning thus embraces not only the volitional process of self-control, but also motivational processes such as academic self-efficacy and learning strategies such as asking for feedback from teachers. Likewise, outside of educational psychology, the term self-regulation is sometimes used synonymously with self-control but usually refers to a more expansive set of goal-directed processes, including motivation (Carver & Scheier 1981, Davisson & Hoyle 2017).

AGC: academic goal–congruent

AGI: academic goal–incongruent

Big Five Conscientiousness: a family of personality traits encompassing self-control, as well as orderliness, dependability, grit, and the tendency to comply with norms

Executive function: cognitive capacities including inhibitory control, working memory, and cognitive flexibility

In the personality literature, self-control is a facet of Big Five Conscientiousness—a broad family of personality traits that encompasses the facets of orderliness, dependability, grit, and the tendency to comply with social norms (Caspi & Shiner 2006, Eisenberg et al. 2014, Moffitt et al. 2011, Park et al. 2017). The link between self-control and Big Five Conscientiousness is particularly salient in the context of schoolwork (Park et al. 2017), but it should be noted that, in the context of interpersonal relationships (e.g., allowing others to speak without interruption), self-control is also related to Big Five Agreeableness (Park et al. 2017, Tsukayama et al. 2013), and in the context of regulating sadness, anxiety, and other negative emotions, self-control is also related to Big Five Neuroticism (Gross & John 2003).

In the cognitive neuroscience literature, the term executive function is sometimes used interchangeably with self-control. The conceptual overlap between executive function and self-control is plain: Core executive functions include top-down inhibitory control, working memory, and the cognitive flexibility to switch perspectives when demands require doing so (Blair 2016, Diamond 2013, Zhou et al. 2012). Nevertheless, meta-analyses reveal surprisingly weak correlations between task measures of executive function and questionnaire measures of self-control (Duckworth & Kern 2011, Sharma et al. 2014). Thus, while the basic mental processes that compose executive function no doubt lay the foundation for self-controlled behavior, it seems that doing what we know is in our long-term best interests despite momentary temptations also depends on learned strategies and habits that are not well assessed by executive function tasks.

Two features distinguish self-control from related concepts. First, self-control is necessarily self-initiated. Thus, if a student puts away their cell phone to concentrate on math, they are exercising self-control. In contrast, if their teacher takes away the phone, then the student is merely complying with authority (Eisenberg et al. 2014). Although the self in self-control is essential, this does not mean that exercising self-control is always conscious. As we discuss below, self-control can take the form of habits, rules, and plans that were consciously self-initiated in the past but that, in the moment, take the form of automatic responses occasioned by situational cues.

Second, self-control is only relevant to choices in which one option is recognizably more valuable in the long run than the other but in which, nevertheless, the less valuable option is momentarily more attractive. What does it mean for one option to be more valuable? It means that the more valued option is preferred to the less valued option upon reflection; consummating a less valued option may be more gratifying in the moment but is soon regretted. This is because goals are organized hierarchically, with lower-level goals serving as means to higher-level goals (Kruglanski 1996). For example, in **Figure 1**, the goal of immediate pleasure serves no master, but the goal of doing well in school does. As Frankfurt (1988) has pointed out, the capacity to set aside what we merely want to do in the moment for what we more enduringly want to want to do makes it possible for us to engage in self-control.

WHY SELF-CONTROL IS NEEDED IN ACADEMIC CONTEXTS

In **Table 1**, we provide verbatim vignettes from high school students asked to describe a recent experience requiring self-control. Notably, the AGC responses could be from almost any century, while many of the AGI responses specify temptations unique to the modern era.

Why do most students need to exercise self-control to succeed in academic contexts? The answer appears straightforward: It is because students recognize the value of academic work for their future, but in the moment in which they are completing it, they typically do not enjoy it. In **Figure 2**, experience sampling data from a nationally representative study of over 1,000 middle and high school students indicate that academic work (e.g., completing homework, taking a quiz) is substantially less enjoyable than other daily activities, including socializing with friends or family,

Table 1 Self-control dilemmas described by high school students in Duckworth et al.'s (2016b) study

Self-control dilemma	Academic goal–congruent response	Academic goal–incongruent response
"I had a very important essay due the next day, however there was a huge football game on. I used my self-control to prevent myself from watching the game rather than doing my homework."	Working on an essay	Watching television
"A lot of times it can be difficult for me to concentrate on schoolwork. I was trying to finish an essay before the end of class. It was hard for me to focus because some people had already finished and were talking loudly. I really wanted to talk to them but I needed to finish to improve my grade."	Finishing an essay before the end of class	Talking to classmates
"I wanted to finish an essay but I also wanted to watch Netflix and I was at a great part in [a show called] *The Office* so *The Office* was more important at that time, but I eventually did the essay."	Working on an essay	Watching Netflix
"I use self-control on a daily basis when doing my homework. A specific scenario that has happened more than once is when I am sitting at my desk attempting to study and do homework and I can hear the television blasting my favorite show downstairs."	Doing homework	Watching television
"I once was working on a project with a group of people, and the others did no work on the project. Thus, leaving me to do all the work. I became very angry about this, however I did not lash out on the students I simply told my teacher."	Working on a group project with classmates who are not contributing their share	Lashing out at other students
"One day, I was not able to focus studying because I was Snapchatting and texting constantly. I exercised self-control by turning off my iPhone so I could focus on studying for my bio test."	Studying	Snapchatting and texting
"Once, my sixth grade teacher made it clear that we needed to pay attention to get directions for a test. I told myself that I needed to pay attention. Even though she made the importance of paying attention very clear, I still chose to daydream. When it was time to start the test, I had no idea what I was supposed to do."	Paying attention to directions for a test	Daydreaming
"A time when I used self-control was when I was in elementary school and other kids in my school thought it was cool if you skipped class. However, I did not skip class so I could look cool, instead I ignored what the kids thought and stayed in class."	Attending class	Skipping class to look cool

playing sports or doing hobbies, watching television, and resting. Yet at the same time, students also feel that academic work is more important for their long-term goals than any other activity. The pattern is similar regardless of whether the students are girls or boys, in middle or high school, living in wealthier or poorer neighborhoods, or higher versus lower achieving.

These findings would not have surprised William James (1899, pp. 104–5), who asserted that, no matter how entertaining the instructor, in "schoolroom work," there is inevitably "a large mass of material that must be dull and unexciting." More than a century later, students are still doing homework and studying, organizing their belongings, completing classwork, taking tests, listening to their teachers lecture, and participating in class discussions. Relative to other options, these responsibilities can feel tedious, and mastering new skills and knowledge is inherently difficult (Bjork & Bjork 2011), often precipitating frustration and confusion (D'Mello & Graesser 2012). More generally, the subjective experience of conflict between competing goals is reliably aversive (Inzlicht et al. 2015).

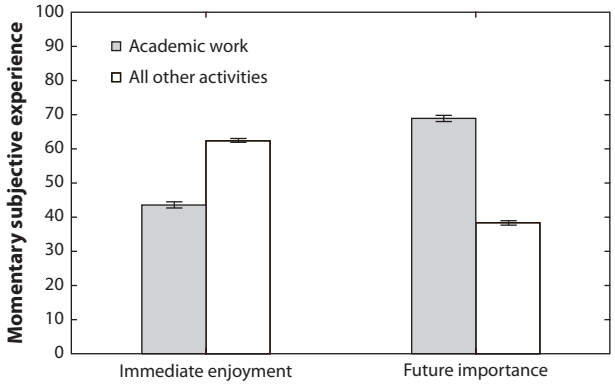

Figure 2

Experience sampling data from a national sample of adolescents show that academic work (e.g., taking a test or quiz, doing homework) is experienced as less enjoyable than other daily activities (e.g., socializing with friends or family, playing sports or doing hobbies, watching television, resting) but simultaneously more important to future goals. Error bars are +/−1 standard deviation of the mean. Data were taken from the Sloan Study of Youth and Social Development (SSYSD; Schneider 2013). The **Supplemental Materials** provide details about the SSYSD and a full reporting of the results of this analysis.

Supplemental Material >

Although the academic duties of students are quite similar across generations, the digital distractions that now compete with them have evolved dramatically in recent years. In one study, undergraduates reported spending more than 7 h per day on their phones (Roberts et al. 2014). In another study, 92% of undergraduates admitted to sending or receiving a text message during class (Tindell & Bohlander 2012). Students aged 13 to 18 now spend more than 5.5 h per day using entertainment media, including television, videogames, laptops, mobile phones, and tablets and excluding reading time; students aged 8 to 12 average more than 3.5 h of entertainment media per day (Common Sense Media 2015). These estimates of recreational media use exclude time spent on computers while in the classroom or at home doing academic work on digital learning platforms.

Often, when students are on screens, they are also multitasking with academic work. While doing homework, for example, many teenagers simultaneously check their social network accounts (50%), watch television (51%), and send and receive text messages (60%) (Common Sense Media 2015). Although the majority of teenagers believe that multitasking has no impact on their work (Common Sense Media 2015), in fact, multitasking typically slows learning (Bowman et al. 2010, Grace-Martin & Gay 2001, Kraushaar & Novak 2010, van der Schuur et al. 2015). Why, then, do students do it? Distractions provide an escape from academic work. For example, in a behavioral task that allowed toggling between doing math problems and, alternatively, watching videos or playing Tetris, boredom increased steadily for students who opted to do math but not for students who opted to entertain themselves (Galla et al. 2014a). Not surprisingly, more self-controlled students voluntarily spent more time on the former. In a naturalistic at-home investigation of studying, students aged 12 to 24 averaged fewer than 6 min on task before interrupting themselves to get up, walk around, text, or check their social media accounts (Rosen et al. 2013).

Since only 70% of US high school students pursue higher education (Kena et al. 2016, table 302.10), one might expect college students as a group to be better at resisting digital distractions. Unfortunately, undergraduates seem to struggle as much as, if not more than, younger students. The majority of college students now use their laptop computers in the classroom (Carter et al. 2017, Patterson & Patterson 2017). Purportedly, a laptop facilitates notetaking and in-the-moment online research. However, taking notes on a laptop is generally less effective than taking notes by hand (Mueller & Oppenheimer 2014), and the more frequently students use

laptops in lecture, the less they are engaged and the lower are their grades (Fried 2008). Moreover, using a laptop creates distractions for other students: 64% of students in one study named laptop use by other students as a distraction, a percentage that is nearly three times higher than that of students' own laptop use and twice as high as all other responses combined (Fried 2008). What is on a neighboring student's screen is likely to be more than just their lecture notes: Even though they knew their in-class usage was being monitored, more than one-third of students' online activity in one recent study was spent checking email, messaging friends through social media, reading the news, shopping, watching videos, and playing games (Ravizza et al. 2017).

SELF-CONTROL PREDICTS ACADEMIC ACHIEVEMENT

Academic achievement is multiply determined: Study skills and learning strategies distinct from self-control predict performance in school (Credé & Kuncel 2008, Hattie et al. 1996). Emotional factors like math anxiety (Foley et al. 2017) are also relevant, and accomplishing especially challenging goals over months and years requires grit (Eskreis-Winkler et al. 2016b). As mentioned above, motivation is prerequisite; the absence of academic motivation renders self-control moot (Richardson et al. 2012, Robbins et al. 2004). Moreover, contextual factors including poverty, stress, and uncertainty dramatically shape academic trajectories in myriad ways, including via their influence on the development of self-control and affordances for its expression (Blair & Raver 2015, Duckworth et al. 2013b, Evans & Rosenbaum 2008, Kidd et al. 2013, Michaelson & Munakata 2016). Given the multitude of influences on academic achievement, it is notable that kindergarten teachers single out aspects of self-control as most essential to success in school (Blair & Raver 2015, Heaviside & Farris 1993). Even more remarkable is the cumulative empirical evidence for the pervasive influence of self-control on academic attainment, academic course grades, and standardized achievement test scores (Duckworth & Carlson 2013).

Academic Attainment

One in four American students drops out of formal schooling before receiving a high school diploma (Heckman & LaFontaine 2007), and one in two college students drops out before graduating (Camara 2013). In prospective longitudinal studies, self-control predicts persisting with formal education (Moffitt et al. 2011) and successfully graduating from both high school (Kelly & Veldman 1964, Vitaro et al. 2005) and college (B.M. Galla, E.P. Shulman, B.D. Plummer, M. Gardner, S.J. Hutt, J.P. Goyer, A.S. Finn, S.K. D'Mello and A.L. Duckworth, manuscript under review). Compared to high school graduates of equivalent intelligence, students who drop out of high school and later pass the GED exam fare worse on a wide range of outcomes associated with lower self-control, including unemployment, criminal activity, dropout from the military, and drug abuse (Heckman et al. 2014).

Academic Course Grades

Self-control predicts course grades at all levels of schooling, including early primary grades (Blair & Raver 2015, Normandeau & Guay 1998), later primary grades (Zhou et al. 2010), middle school (Duckworth & Seligman 2005, Hofer et al. 2012), high school (B.M. Galla, E.P. Shulman, B.D. Plummer, M. Gardner, S.J. Hutt, J.P. Goyer, A.S. Finn, S.K. D'Mello and A.L. Duckworth, manuscript under review), and college (Tangney et al. 2004, Wolfe & Johnson 1995). Inferences about causality in nonexperimental investigations are necessarily limited, but in one 4-year longitudinal study, rank-order changes in self-control over time prospectively predicted changes in report card grades, whereas neither changes in grades nor changes in self-reported self-esteem prospectively predicted changes in self-control (Duckworth et al. 2010).

As noted above, Big Five Conscientiousness is the family of personality traits most related to self-control behaviors in the academic context (Park et al. 2017). In a meta-analysis of more than 70,000 students from primary school through college, the association between grades and Big Five Conscientiousness ($r = 0.19$) was larger than those between grades and Big Five Agreeableness, Openness to Experience, Extraversion, and Emotional Stability. Notably, this relationship was almost as large as that between grades and measured intelligence ($r = 0.23$) (Poropat 2009). A more recent meta-analysis of psychological correlates of university grades corroborates this pattern: GPA in college is more strongly related to Big Five Conscientiousness ($r = 0.19$) than to any other Big Five personality family; the association between GPA and effort regulation in particular is even stronger ($r = 0.32$) (Richardson et al. 2012). Notably, observed effects are largely independent of intelligence (Duckworth & Seligman 2005; Duckworth et al. 2010, 2013c; Poropat 2009).

Standardized Achievement Tests

Self-control also predicts standardized achievement test scores, even when controlling for measured intelligence and family socioeconomic status (Alexander et al. 1993, Blair & Razza 2007, Duckworth & Seligman 2005, Galla et al. 2014b, Martin 1989, Valiente et al. 2010). Likewise, the amount of time that children can wait for a preferred treat in the preschool delay of gratification task predicts SAT scores (Mischel et al. 1989) and other standardized achievement test scores (Duckworth et al. 2013c). The same pattern holds for other tasks requiring inhibition of automatic responses, sustained attention, and keeping instructions in working memory (McClelland et al. 2007).

Interestingly, self-control is more strongly related to course grades than to standardized achievement test scores. For example, in two samples of middle school students, self-control predicted changes in report card grades over time better than intelligence did, an effect mediated by homework completion and classroom conduct (Duckworth et al. 2012). Intelligence, on the other hand, predicted changes in standardized achievement test scores better than self-control did. Among 8,454 high school seniors in the National Education Longitudinal Study, behaviors known to depend on self-control, including attending class regularly and promptly and completing work on time, were more strongly associated with grades than with standardized achievement test scores (Willingham et al. 2002). Likewise, wait time in the preschool delay of gratification task more strongly predicts high school report card grades than standardized achievement test scores (Duckworth et al. 2013c).

The disproportional influence of self-control on course grades explains why grades predict college persistence and graduation better than do standardized achievement test scores (Bowen et al. 2009, Geiser & Santelices 2007). Likewise, a developmental advantage in self-control helps explain why female students earn higher grades than their male counterparts in every subject from primary school through college (Perkins et al. 2004, Voyer & Voyer 2014) despite minimal differences on standardized achievement tests, intelligence, or academic motivation (Duckworth & Seligman 2006, Duckworth et al. 2015).

UNDERSTANDING SELF-CONTROL: HOW IMPULSES ARE GENERATED

Since self-control dilemmas are common in the school context, and since more self-controlled students do better on academic outcomes than their more impulsive peers, what can be done to support the development of self-control? Answering this question begins with an understanding of how AGC and AGI impulses are generated.

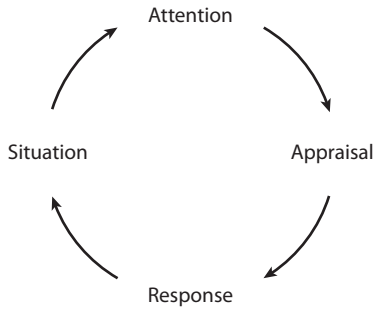

Figure 3

The process model of self-control specifies how features of the situation are subject to attention, which then leads to an appraisal that, in turn, strengthens or weakens particular response tendencies. Figure adapted with permission from Duckworth et al. (2014).

The process model of self-control (Duckworth et al. 2014) specifies how such impulses are generated and, relatedly, the diverse ways in which these impulses can be regulated. As a preliminary, this model assumes that multiple goals are often activated within the same individual at the same point in time. In other words, a person is often of two (or more) minds about what to do, think, or feel in a given situation. Sometimes, only one goal is active. Other times, two or more goals are active and interact in harmonious ways. For example, a student may be excited to take a field trip to the local science museum both to spend time with their friends and also because they are interested in the museum's human anatomy exhibit. In cases of self-control conflict, however, the action that serves an immediately gratifying goal is at odds with a different goal that is more enduringly valued. In **Figure 1**, for instance, a student urgently wants to respond to social media notifications on their cell phone; at the same time, they have a momentarily weaker impulse to study that aligns with the more valued goal of doing well in math class and, in turn, of one day becoming a doctor.

As shown in **Figure 3**, the process model of self-control describes the recursive process by which impulses (i.e., response tendencies) are generated over time. This model's starting point is the common-sense observation that each person exists in an objective situation. For example, as the same student travels from home to school and back, they traverse worlds of differing physical and social contours. One setting may elicit anger whereas another may elicit calm (Mischel et al. 2002). To any given situation, each person brings a unique store of schemas, memories, associations, values, interests, identities, and beliefs (Dweck 2017, Mischel & Shoda 1995). Such person-level differences help to explain individual differences in responses to what appears, to an outside observer, to be the same objective situation.

The next step in the model revolves around the idea that, because the human capacity for attention is limited, a person necessarily attends to a small subset of features in the objective situation while ignoring all others (Kahneman 1973, Pashler & Johnston 2016). Likewise, attention can be directed inward, with the inner gaze of a person activating particular memories, thoughts, beliefs, or other mental representations. In other words, attention is like a spotlight illuminating only a tiny portion of our external and internal landscapes, leaving the vast majority of both in obscurity.

Next, a person interprets these activated perceptions. An appraisal is a subjective interpretation of whatever is being perceived, particularly with respect to whether it is good for the individual

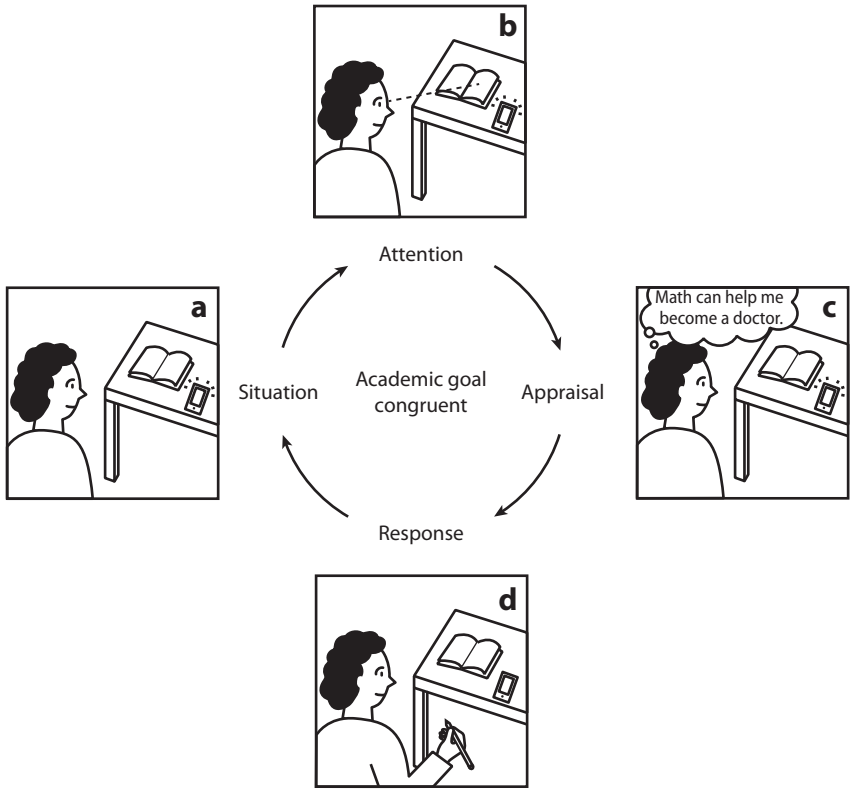

Figure 4

Studying is a response that is congruent with the academic goal of doing well in math. How does the impulse to study math develop? In this example, (*a*) a student who enters their bedroom (*b*) directs attention toward their math textbook and away from their buzzing cell phone. (*c*) Next, they think about how doing well in math will make it possible to become a doctor later in life. (*d*) Finally, this thought inclines them to pick up a pencil and get to work.

or bad for them. Appraisals can precipitate quickly and without conscious awareness, or they can develop more deliberately (Lazarus 1991).

In either case, appraisals lead to an approach or avoidance response tendency that, as the cycle repeats, can either wax or wane. Response tendencies that reach a threshold are discharged, resulting in changes to the situation or the person. The cycle then repeats anew.

We can use the process model of self-control to understand how the AGC impulse to study math in **Figure 1** might be generated. As shown in **Figure 4**, a student approaches the desk in their bedroom. Side by side atop the desk lie their math textbook, open to the page where they stopped studying the evening before, and their cell phone, now buzzing with Instagram alerts. Immediately, the student looks at the math textbook. This image brings to mind their dream of becoming a doctor and the thought that doing well in math is important to that long-term goal. The consequent appraisal ("math is good for me because it can help me become a doctor") strengthens their impulse to study. They pick up their pencil. Now their situation has changed: Not only are they one step closer to studying math, they would also have to put down their pencil to pick up their cell phone.

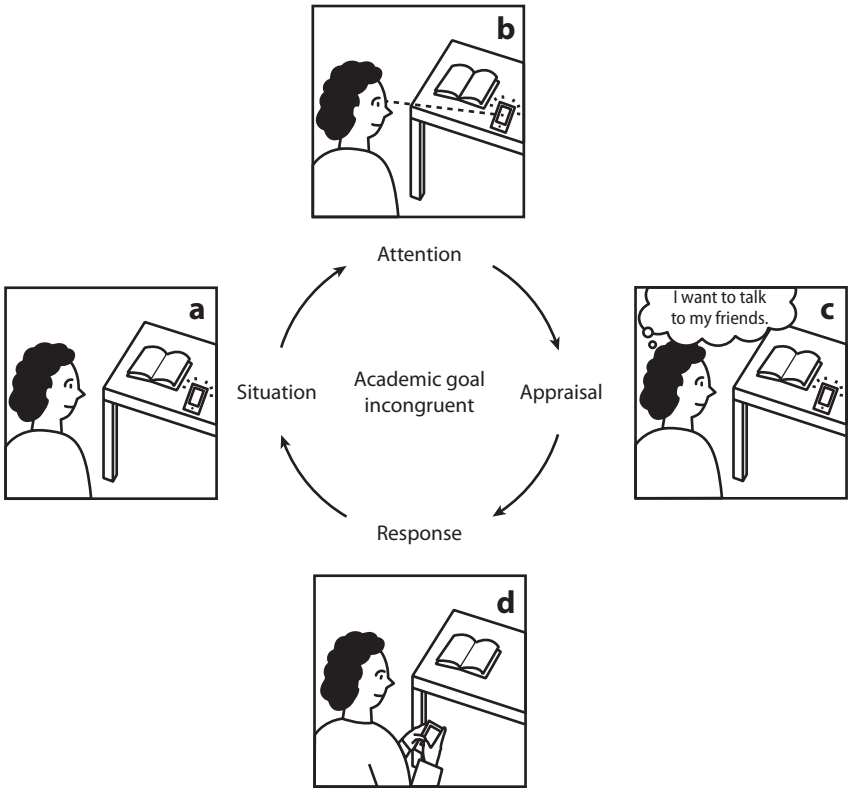

Figure 5

Checking social media is a response that is incongruent with the academic goal of doing math homework. How does the impulse to check social media develop? (*a*) First, a student who enters their bedroom (*b*) might direct attention to their buzzing cell phone, ignoring the math textbook beside it. (*c*) Next, they think about much they want to talk to their friends. (*d*) Finally, this thought inclines them to pick up their phone.

Although students would like to do well in school, they also experience myriad impulses motivated by AGI goals (as described in **Table 1**). For instance, it is natural for students to seek positive attention from their friends. Accordingly, it is easy to imagine the sequence of events depicted in **Figure 5**. A student confronted with their math textbook and their buzzing cell phone looks at their phone, thus inclining them to wonder what their friends are doing. The consequent appraisal ("texting is good") leads them to pick up their cell phone and check their Instagram feed. Now their objective situation has changed: They are holding their cell phone and getting immediate responses to their posts, thus making the impulse to stay on social media stronger.

UNDERSTANDING SELF-CONTROL: HOW IMPULSES ARE REGULATED

In self-control dilemmas, impulses that can be immediately gratified tend to be stronger than impulses whose benefits redound later in time (Rachlin 2000). At younger ages, when self-control competence is minimal, students rely on teachers and parents to adjudicate these conflicts. However, as they grow older, students must learn to govern their own conflicting impulses (Eisenberg

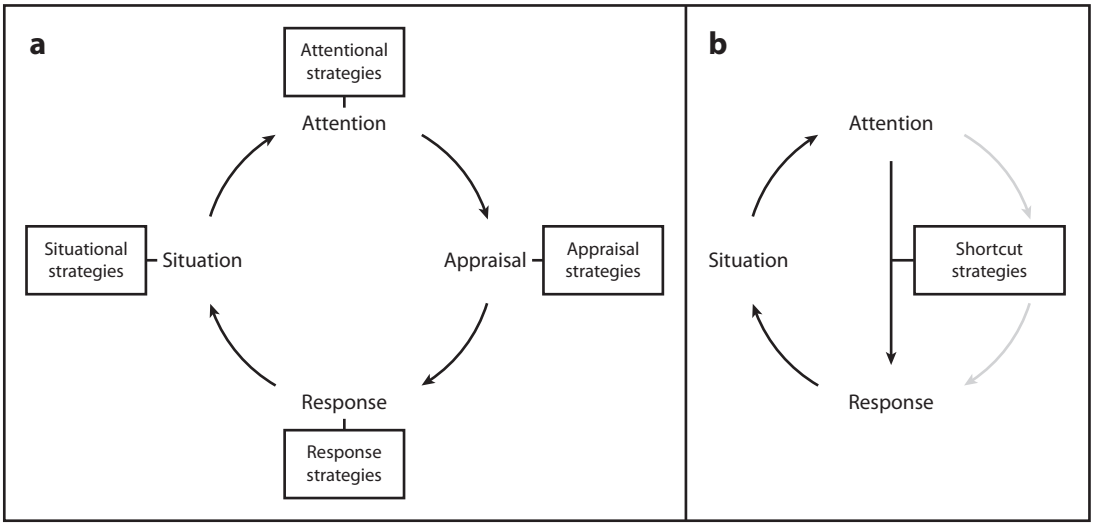

Figure 6

(*a*) Self-control can take the form of intervention at any stage of impulse generation. (*b*) Plans, personal rules, and habits short-circuit the cycle of impulse generation. Trigger cues in the situation tend to draw attention, leading directly to previously rehearsed responses.

et al. 2014). By adulthood, as Schelling (1978, p. 290) has observed, students have ideally developed an arsenal of "little tricks we play on ourselves to make us do the things we ought to or to keep us from the things we ought to foreswear."

These little tricks can be organized according to stages of the process model of self-control. Specifically, as shown in **Figure 6*a***, students can intentionally modify the default cycles of either AGC or AGI impulse generation at the situational, attentional, appraisal, and response stages. In so doing, students instantiate cascading influences that ultimately augment the strength of AGC impulses or decrease the strength of AGI impulses. In addition, as illustrated in **Figure 6*b***, students can shortcut the process of impulse generation, in particular by employing plans, personal rules, and habits to avoid appraising the costs and benefits of alternative responses. As is made clear below, all of these strategies have advantages and disadvantages.

Situational Strategies

The most forward-looking self-control strategies target one's situation well in advance of an encounter with temptation (Duckworth et al. 2016a). Imagine, for example, the dilemma in **Figure 1** taking place in the school library. In the library, the student encounters their math book lying next to their cell phone against the backdrop of a quiet and well-lit room lined with bookcases. Around them, perhaps, are a few other students, all quietly reading and writing rather than talking or texting. These physical and social cues tend to prime AGC impulses and dampen AGI impulses, whereas the context of a typical teenager's bedroom may do the opposite.

Several correlational studies support the common-sense intuition that some situations are more conducive to academic work than others. Students who sit in the front of the classroom, compared to those sitting farther away from the teacher, tend to be more academically engaged and successful (Benedict & Hoag 2004, Schwebel & Cherlin 1972, Tagliacolloab et al. 2010, Walberg 1969). One study found that students randomly assigned to sit in the front of the classroom were rated as more attentive by both their teachers and their peers (Schwebel & Cherlin 1972). At home,

higher-achieving students prefer to study alone and in quiet, well-lit spaces (Hong 2001, Spellman et al. 2002). The preference for working alone versus with others strengthens with age (Kackar et al. 2011), a pattern that has also been observed among adult experts across fields (Ericsson 2006). Relatedly, experience sampling data show that, while studying with friends is more enjoyable than studying alone, concentration and effort are greater when studying alone than when studying with friends (Shumow et al. 2008).

In addition to selecting situations to advantage, students can modify their situations in situ. For example, more self-controlled students report fewer distractions (e.g., cell phone, television) in their line of sight when studying (Ent et al. 2015). In two intervention field studies, high school and college students, respectively, were introduced to the idea of "removing temptations from sight rather than trying to resist them directly" (Duckworth et al. 2016b, p. 335). Students were remarkably resourceful: Some found apps that blocked access to social media, some put their phones on mute, and others turned their phones and computers off entirely. Compared to students prompted to use willpower or students given no strategy at all, treated students were more successful at achieving their academic goals the following week. Likewise, in two samples of college students, those randomly assigned to keep their laptops closed during a lecture remembered more content than students allowed to keep their laptops open (Hembrooke & Gay 2003).

Another way to modify situations is to create a deadline or contract whose violation is costly. In one experiment, university students given the opportunity to precommit to deadlines for assignments with a grade penalty for tardiness performed better than students given freedom to complete the same assignments at any point in the semester (Ariely & Wertenbroch 2002). Note, however, that, in the same study, students whose instructors simply enforced a common set of deadlines performed even better. In addition, a recent field study of middle school students failed to show measurable benefits of precommitment on in-school conduct despite evidence, based on voluntary enrollment, of awareness that precommitment could be beneficial (Robinson et al. 2018). A more extensive literature on precommitment in adults reveals substantial complexities and challenges of precommitment contracts (Bryan et al. 2010).

Rather than self-imposing penalties for AGI behavior, therefore, it may be more beneficial to pair rewards with AGC behavior. For instance, outside the academic context, gym-goers who allow themselves to read pulp fiction only when they are at the gym are more likely to stick to their exercise routine (Milkman et al. 2014). Likewise, the boredom-alleviating effects of music (Sansone et al. 1992) may explain why nearly 8 in 10 students listen to music while doing their homework (Common Sense Media 2015). Of course, background music can also be distracting (Anderson & Fuller 2010). What effects do material rewards have? In large-scale, random-assignment field trials, students paid to improve their academic performance have not reliably outperformed their classmates (Fryer 2011). It may be that material rewards pair more effectively with inputs (i.e., proximal goals such as studying) than with outputs (i.e., distal outcomes such as grades or achievement test scores) (S. Hirshleifer, unpublished manuscript). For instance, students might promise themselves a snack for studying for a certain amount of time.

Attentional Strategies

Sometimes, we are confronted with situations that we can neither choose nor change. In such cases, it is possible to direct our attention toward the subset of situational features or mental representations that strengthen desirable impulses and weaken undesirable impulses. In **Figure 4**, for example, a student stokes the impulse to do math by intentionally looking toward their math textbook and, at the same time, dampens the impulse to check social media by looking away from their cell phone. Likewise, the same student could direct their internal gaze toward AGC thoughts

(e.g., reminders of how much they like their math teacher) and away from AGI thoughts (e.g., wondering how many likes their last Instagram photo received). Though directing attention does not change our objective reality, it dramatically influences subjective experience, rendering what we do not notice unreal, in a sense (Simons & Ambinder 2005).

In correlational studies, children who spontaneously divert their gaze away from temptations are better able to resist them than children who stare at them directly (Mischel et al. 1988, Rodriguez et al. 1989). Selective attention has also been shown to facilitate working, rather than passively waiting, for delayed rewards. For instance, preschool children completing a boring task while "Mr. Clown Box," a toy with flashing lights, beckoned to them ("Come play with me!") were more industrious when encouraged by experimenters to focus attention away from the toy and toward the task (Patterson & Mischel 1975). More recently, imaging studies have found that diverting attention from temptations undermines intrusive thoughts about temptations and increases engagement of prefrontal brain regions (van Dillen & Papies 2015).

It can also be advantageous to direct attention to one's own behavior. Self-monitoring refers to intentional and consistent self-observation, particularly for the purpose of highlighting deviations from desired behavior. Extensively studied as a strategy for dieting and smoking (Burke et al. 2011, McFall 1970), self-monitoring has, in a handful of studies, been shown to help students study more assiduously (Schmitz & Perels 2011, Zimmerman & Paulsen 1995). For instance, in one early study, elementary school students randomly assigned to keep journals on their classroom behavior studied more and performed better academically (Sagotsky et al. 1978). To our knowledge, self-monitoring has attracted scant interest from self-control researchers in recent years, perhaps because it requires obsessive vigilance (Baker & Kirschenbaum 1993, Kirschenbaum 1987). It may be more practical, therefore, to occasionally practice mentally contrasting a desired future with the present obstacles that stand in the way (Gollwitzer et al. 2011). For example, imagining the proud day on which they will graduate from medical school and synchronously reflecting on how much time they currently waste on social media may energize a student's commitment to studying instead of procrastinating.

Mindfulness is another attentional strategy that is defined as sustained and nonreactive awareness of ongoing subjective experience (Anālayo 2003, Brown & Ryan 2003, Grabovac et al. 2011). Through dispassionate observation, students may enhance awareness of AGC–AGI goal conflict, allowing greater appreciation of the need for self-control (Elkins-Brown et al. 2017). The benefits of mindfulness for mood and mind wandering have been well documented in laboratory and correlational studies, but rigorous field studies of mindfulness training in academic contexts are lacking (Creswell 2017, Mrazek et al. 2017). Moreover, mindfulness is a learned skill whose practice is itself effortful, thus requiring self-control (Galla et al. 2016).

Appraisal Strategies

When situations cannot be altered and when attending to temptations is unavoidable, it is still possible to change the way we think. The appraisals that we construct can feel incontrovertibly real, but in fact, the way in which we interpret our circumstances is subjective. For students, it is beneficial to appraise situations in ways that strengthen AGC impulses, weaken AGI impulses, or both. For example, the student facing the self-control dilemma in **Figure 1** might decide to frame a difficult math assignment as a stepping-stone to medical school instead of as pointless busy work. When considering their Instagram notifications, they might think about them as annoying interruptions or as a waste of time rather than as their friends needing them or as a break that they deserve to take.

The extensive literature on expectancy-value models of achievement motivation suggests several ways to strengthen AGC impulses (Hulleman et al. 2016a). The value of academic work is

greater when it is perceived as relevant to the student's interests and personal life (Hulleman et al. 2016b), important to helping other people (Yeager et al. 2014), or relevant to the student's identity (Berkman et al. 2017, Eskreis-Winkler et al. 2016a) or character (Magen & Gross 2007). Just as the perceived benefit of academic work can be boosted, so, too, can the perceived cost be diminished. For instance, students try harder when they appraise the emotion of frustration as a sign that they are challenging themselves and improving (Eskreis-Winkler et al. 2016b).

Expectancies of success also matter: AGC impulses are stronger when students believe that they can succeed in an academic task if they try (Zimmerman et al. 1992). Accordingly, when students believe that abilities like intelligence can change, they construe academic challenges as opportunities for growth (Dweck et al. 2014). Self-efficacy is also enhanced when distal outcome goals are broken down into smaller proximal goals (Latham & Seijts 1999). For instance, struggling math students encouraged to pursue proximal goals (a certain number of problems per study session) developed greater self-efficacy and learned more than students randomly assigned to pursue distal goals (completing the same total number of goals over the same total number of sessions) (Bandura & Schunk 1981).

Temptations, too, can be appraised in ways that change their expected value. For example, psychological distance from the current moment tends to shift appraisals toward more abstract, higher-level construals (Fujita & Carnevale 2012, Kross & Ayduk 2017). In the preschool delay of gratification task, children cued to dwell on nonappetitive features of rewards (e.g., "When you look at marshmallows, think about how white and puffy they are. Clouds are white and puffy, too.") waited twice as long as children cued to dwell on their appetitive features ("When you look at marshmallows, think about how sweet they are when you eat them.") (Mischel & Baker 1975, p. 257). Likewise, children asked to pretend that actual rewards were just a picture by "putting a frame around them in your head" waited more than twice as long as children shown a picture of the rewards but asked to imagine that they were real (Moore et al. 1976). The cost of resisting temptation is also subjective: Undergraduates prompted to think of self-control as a nonlimited (versus finite) resource exhibited better self-control after a difficult activity (Job et al. 2010). Young children who were read a story that represented self-control as energizing were also more likely to delay gratification for longer (Haimovitz et al. 2018).

In principle, expectancies regarding temptation are also relevant. One can imagine students doubting the strength of local WiFi connectivity and thereby discouraging themselves from turning on their cell phones. However, the temptations that lure students away from their academic work are, in general, more certain. Whereas students may question their ability to succeed in school, they are unlikely to doubt their competence at scrolling through their social media accounts, sending and receiving text messages, daydreaming, or watching videos on Netflix or YouTube. Indeed, it is in part the certainty with which immediate temptations are expected to deliver pleasure that makes them so seductive (Frederick et al. 2002).

Much of the evidence for the importance of appraisals comes from studies that have exogenously manipulated how perceptions are interpreted. Can students self-initiate such changes? A half century of research on cognitive therapy affirms that it is possible to learn how to intentionally change maladaptive appraisals into more adaptive representations (for a review, see Beck & Dozois 2011). More recently, cognitive therapy techniques developed for adults suffering from depression and anxiety have been adapted for nonclinical populations, including children and adolescents (Seligman 2007). Cognitive therapy has also been successfully applied to addiction, binge eating, and other disorders of self-control (Baer et al. 2005, Carroll et al. 2008). The benefits of cognitive therapy have been documented after the conclusion of therapy, indicating that at least some individuals are able to sustain reappraisal of their situations without the direct support of a therapist (Hollon et al. 2005). Collectively, this clinical research is encouraging, but we are unaware of any

adaptation of cognitive therapy techniques specifically for self-control dilemmas in the academic context.

Response Strategies

Our appraisals of what is likely good for us and what is likely bad for us lead to response tendencies that, once they reach a certain threshold, are enacted. At this final stage, it is possible to directly modulate responses. Students can simply force themselves to study or resist their buzzing cell phones. Although it is more evolved in human beings than in any other species, the capacity to effortfully enact or inhibit responses is quite fallible (Cohen 2005). Failures of willpower are commonplace, both in everyday life (Hofmann et al. 2012) and on the simplest laboratory tasks of response inhibition (Stroop 1935). Moreover, response modulation reliably precipitates feelings of fatigue and negative affect (Inzlicht et al. 2014, Kurzban et al. 2013, Westbrook & Braver 2015). Our view, therefore, concurs with ancient Buddhist wisdom (Nanamoli & Bodhi 1995): Response modulation is a self-control strategy of last resort.

Very little experimental research in the academic domain has examined the efficacy of response modulation in comparison to strategies deployed earlier in the cycle of impulse generation. One exception is a study by Duckworth et al. (2016a), in which high school and college students encouraged to use willpower to accomplish their academic goals were no more successful than students in a no-treatment control group. Also relevant are early goal setting experiments, in which "do your best" exhortations were generally found to be less effective in motivating effort than encouraging the identification of specific and challenging goals (Locke & Latham 2002).

"Just Do It" may be an empowering mantra, and is certainly a catchy marketing slogan, but "just" as a preamble hints at a lack of artfulness. The "Just Say No" antidrug campaign, for instance, which led to the Drug Abuse Resistance Education (DARE) program, was widely implemented by schools in the 1980s but has shown no discernible benefits (West & O'Neal 2004). Similarly, abstinence-based programs do not reliably decrease teen pregnancy (Trenholm et al. 2008).

Shortcut Strategies

In addition to targeting each of the four stages of impulse generation, we can use plans, personal rules, or habits to link anticipated situational cues with desired responses. As shown in **Figure 6*b***, all three strategies effectively abridge the cycle of impulse generation by bypassing the appraisal stage altogether. Circumventing the deliberation of how good or bad something is for the individual supports self-control because a one-time indulgence is typically more rewarding than one-time abstemious and effortful investment in a far-off and less certain outcome (Prelec & Loewenstein 1991, Rachlin 2000). Countless laboratory and field studies affirm that the future is discounted hyperbolically: Delayed rewards are valued dramatically less than immediate rewards (Rachlin 2000). Indeed, repeated acts of self-control are typically superior only in the aggregate. For example, the AGC pattern of studying each weekday evening undeniably improves academic outcomes. However, on any particular evening, the competing AGI response of goofing off "just this once" instead of hitting the books may bring greater happiness. Individually appraising each choice in the moment, therefore, a student might repeatedly choose to have fun over studying.

Planning in advance is an antidote to the perils of comparing hyperbolically discounted AGC responses with undiscounted AGI responses. A plan strategically links an anticipated situational cue with a desired behavioral response. For example, hours before choosing between studying and social media, the student in **Figure 1** might formulate a plan: "When I walk into my bedroom, I will study math." Not only do plans direct attention toward anticipated situational features, they also forge a strong mental link between these cues and desired behaviors (Gollwitzer 1999).

Although they are formed consciously and intentionally, plans enable relatively effortless and automatic responses. Hundreds of separate experiments have demonstrated that plans increase striving toward valued goals in a wide range of domains, including academic work (Gollwitzer & Sheeran 2006). In one longitudinal field study, fifth graders who practiced goal setting and planning improved their report card grades, attendance, and in-class conduct the following marking period (Duckworth et al. 2013a).

Like plans, personal rules (Ainslie & Haslam 1992) link situational cues directly to desired responses. By definition, however, personal rules are categorical ("When I get home, I always do my homework.") because exceptions undermine their power (Bénabou & Tirole 2004). Although rigidity has its costs, rules can help students avoid the "just this once" rationalizing that favors AGI over AGC impulses. Indeed, a personal rule "overrides cost-benefit calculation with respect to that action" (Prelec & Herrnstein 1991, pp. 320–21). The logic of personal rules is intuitive, and anecdotal evidence regarding their efficacy is abundant. Moreover, it would seem that "making personal rules is obviously a learnable skill" (Ainslie & Haslam 1992, p. 190). Nevertheless, we are unaware of recent empirical research on personal rules as a self-control strategy for students.

A habit is a learned if–then association directly linking particular situational cues to particular behavioral responses. Like plans, and perhaps to an even greater extent, habits are executed automatically and without conscious awareness. Also like plans, habits bias attention toward trigger cues and circumvent the appraisal stage entirely (Neal et al. 2012). Unlike plans or personal rules, however, the development of habits necessarily takes place over extended periods of time, as cue–behavior sequences are repeated and reinforced over weeks or months (Lally et al. 2010). Students cannot simply plan or resolve to have study habits; they must consistently enact behaviors that eventually become habits.

Recent research has illuminated the enormous potential of habit creation as a self-control strategy (Carden & Wood 2018). Self-controlled students earn higher grades in large part because of stronger study habits (e.g., studying in the same place and at the same time each day; Galla & Duckworth 2015). In experience sampling method (ESM) and diary data collected over a semester, college students who experienced fewer temptations were more successful at attaining their goals, but effortful self-control was unrelated to goal attainment (Milyavskaya & Inzlicht 2017). In a separate ESM study, more self-controlled adults experienced less motivational conflict and reported less frequent inhibition of temptation-related impulses (Hofmann et al. 2012). Finally, meta-analyses reveal that trait-level self-control measures predict "behaviors that are performed efficiently, unintentionally, without awareness and conscious control" more reliably than behaviors "requiring conscious attention or deliberation" (de Ridder et al. 2012, p. 83).

One can easily imagine a student who makes a plan ("When I get home today, I will study math.") finding that it works well and turning this plan into a personal rule ("When I get home, I always study math."), which, with repetition over an extended time frame, eventually becomes a habit. Notably, however, goals, by necessity, recede in salience during the formation of habits (Dickinson et al. 1995, Gillan et al. 2015, Rangel et al. 2008). Thus, the conceptual parallels between plans, personal rules, and habits may belie antagonistic underlying processes.

FUTURE DIRECTIONS

Our review of theoretical and empirical work on self-control in academic contexts makes clear just how important a role self-control plays in determining a wide range of key academic outcomes. Our review also suggests three areas in which additional self-control research is urgently needed.

First, our process-oriented perspective on self-control reveals the paucity of intervention research targeting specific self-control strategies. Self-control intervention research in the heyday

of behaviorism (Beneke & Harris 1972, Eisenberger et al. 1985, Meichenbaum 1979) yielded encouraging findings but relied on tiny samples and a conceptual framework that altogether omitted cognitive appraisals. Thus, there remains an enormous opportunity for process-oriented intervention research that is carried out in accordance with current best practices in social science. Ideally, interventions would differ from extant studies in which experimenters have exogenously manipulated situations, attention, appraisals, and responses or instigated planning, personal rules, or habits. Instead, we look forward to ambitious training efforts aimed at equipping students with the metacognitive knowledge and skills required to initiate such changes themselves. We are especially optimistic about interdisciplinary efforts between psychologists of different theoretical traditions and among psychologists, educators, and students themselves.

Second, almost nothing is known about the moderators and boundary conditions of self-control strategies in the academic context. Which self-control strategies work best under which circumstances and for whom? For instance, does psychological distancing work for weakening AGI impulses but not for strengthening AGC impulses? Are self-control strategies especially important for students with poor executive function and, thus, the least capacity to modulate responses in the heat of the moment? What are the consequences of normative developmental changes? The strength of AGI impulses tends to increase during adolescence, as reward-seeking and risk-taking tendencies reach their developmental apogee (Duckworth & Steinberg 2015). In contrast, executive function tends to develop slowly, and monotonically, through at least the first two decades of life (Best & Miller 2010).

Finally, much remains to be discovered about policies and practices that minimize the burden of self-control on students. Although it may not be possible to altogether eliminate the need for self-control, the school experience should be designed to be as intrinsically engaging as possible. For instance, students find individual and group work more engaging, interesting, and enjoyable than lectures (Shernoff et al. 2014). Relatedly, intrinsic motivation is enhanced by autonomy, competence, and a sense of group belonging (Ryan & Deci 2000). Practically speaking, then, teachers might learn to skillfully integrate peer tutoring, personalized learning, and project-based learning into instructional practice. Unfortunately, such approaches to learning are rare and likely become rarer still as students progress through middle and high school, paralleling monotonically decreasing levels of academic engagement over the same years (Gallup 2015). Educators can also take steps to eliminate digital distractions, particularly those that impinge upon learning in the classroom. One recent longitudinal study found that undergraduates whose professors restricted the use of laptops in class earned higher course grades, with male and low-performing students benefiting most (Patterson & Patterson 2017). Similarly, in a randomized controlled trial at the US Military Academy, final exam scores were higher in classrooms that prohibited laptops or tablets, with a trend toward benefits accruing disproportionately to male students (Carter et al. 2017). Beland & Murphy (2016) likewise found that the benefits of banning mobile phones in high schools in the United Kingdom were concentrated among low-achieving students.

CONCLUSION

The choice between schoolwork and easier, more immediately rewarding diversions is a perennial challenge for students. This may be why self-control predicts academic achievement at every level of schooling. In recent decades, scientific understanding of self-control has advanced considerably. It is now well established that the process by which impulses develop is recursive, moving from the objective situation, to the features of the situation that enter attention, to the appraisals of these perceptions, and finally to the responses to these appraisals. Students can strengthen AGC impulses or weaken AGI impulses by targeting any of these stages, or they can shortcut the process

by making plans, personal rules, or habits. In sum, our review suggests that, although much has been learned about self-control in the academic context, much remains to be discovered.

SUMMARY POINTS

1. Self-control is distinguished from related concepts by two cardinal features. First, self-control is necessarily self-initiated. Second, self-control is only relevant to choices in which one option is recognizably more valuable in the long run than the other, but in which the less valuable option is momentarily more attractive.
2. School presents a classic self-control dilemma: Almost all students experience conflict between academic goals that they value in the long run and nonacademic goals that they find more gratifying in the moment.
3. Individual differences in self-control reliably predict academic attainment, course grades, and performance on standardized achievement tests. The predictive power of self-control for academic achievement is not unique—other factors, including socioeconomic status, general intelligence, motivation, and study skills, are also relevant—but is nevertheless remarkable for its robustness and ubiquity across academic outcomes.
4. The process model of self-control (Duckworth et al. 2014) describes the recursive process by which impulses are generated and regulated over time. The model posits four stages by which impulses are generated. First, a person enters a situation. Next, the person pays attention to particular features of the situation. These perceptions then give rise to subjective appraisals. Finally, these appraisals lead to the generation of response tendencies that, once sufficiently strong, are discharged.
5. According to the process model of self-control, self-control strategies can be organized according to which stage of impulse generation they target: The most forward-looking self-control strategies target the objective situation well in advance of encountering temptation. When situations cannot be modified, it is possible to direct our attention toward situational features or mental representations that strengthen desirable impulses and weaken undesirable impulses. When attending to temptations is unavoidable, it is possible to change our subjective appraisals of them. The least artful and most obvious of strategies entail directly modulating responses (i.e., using willpower).
6. Plans, personal rules, or habits are strategies that effectively abridge the cycle of impulse generation by bypassing the appraisal stage altogether, linking anticipated situational cues with desired responses.

FUTURE ISSUES

1. Given the importance of self-control to academic achievement, the lack of intervention research aimed at improving self-control in students is surprising. We see enormous potential for interdisciplinary collaborations among psychologists of different theoretical traditions and among psychologists, educators, and students themselves.
2. Almost nothing is known about the moderators and boundary conditions of self-control strategies in the academic context. Future research is needed to establish which self-control strategies work best under which circumstances and for which students.

3. Much remains to be discovered about policies and practices that minimize the burden of self-control on students. Although self-control will always be important for success in and outside the classroom, learning and instruction should be designed to be as intrinsically engaging as possible.

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