A Stitch in Time: Strategic Self-Control in High School and College Students

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Abstract

A growing body of research indicates that self-control is critical to academic success. Surprisingly little is known, however, about the diverse strategies students use to implement self-control or how well these strategies work. To address these issues, we conducted a naturalistic investigation of self-control strategies (Study 1) and two field experiments (Studies 2 and 3). In Study 1, high school students described the strategies they use to manage interpersonal conflicts, get academic work done, eat healthfully, and manage other everyday self-control challenges. The majority of strategies in these self-nominated incidents as well as in three hypothetical academic scenarios (e.g., studying instead of texting friends) were reliably classified using the process model of self-control. As predicted by the process model, students rated strategies deployed early in the impulse-generation process (situation selection, situation modification) as being dramatically more effective than strategies deployed later (attentional deployment, cognitive change, response modulation). In Study 2, high school students randomly assigned to implement situation modification were more likely to meet their academic goals during the following week than students assigned either to implement response modulation or no strategy at all. In Study 3, college students randomly assigned to implement situation modification were also more successful in meeting their academic goals, and this effect was partially mediated by decreased feelings of temptation throughout the week. Collectively, these findings suggest that students might benefit from learning to initiate self-control when their impulses are still nascent.

Keywords

Self-control; self-regulated learning; metacognition; metacognitive skills; character

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A burgeoning research literature shows that students who can resist momentarily rewarding temptations in the service of more enduringly valued goals excel academically (Duckworth & Carlson, 2013; Walter Mischel, Shoda, & Rodriguez, 1989; Véronneau, Hiatt Racer, Fosco, & Dishion, 2014), thrive socially (Eisenberg, Hofer, Sulik, & Spinrad, 2014), and flourish physically (Tsukayama, Toomey, Faith, & Duckworth, 2010). Remarkably, the predictive power of self-control for consequential life outcomes rivals that of family socioeconomic status and general intelligence (Daly, Delaney, Egan, & Baumeister, in press; Duckworth & Seligman, 2005; Moffitt et al., 2011), affirming age-old speculation that the ability to manage conflicting desires may be at least as critical to psychosocial development as any other competency (Aristotle, 350 BCE/1999; Freud, 1916–1917/1977; James, 1899). In the current investigation, we systematically examine how high school and college students exercise self-control in their everyday lives and test the relative effectiveness of strategies deployed earlier, when impulses are still nascent, rather than later, when impulses have grown in strength.

Defining and Describing Self-Control

Self-control refers to the voluntary regulation of conflicting thoughts, feelings, and actions in accordance with long-term goals. In a self-control dilemma, the individual wants to do something that is immediately rewarding and, in addition, wants to do something else that has more enduring personal value. For example, students are often confronted with choosing between engaging diversions (e.g., texting friends) and academic work (e.g., doing algebra homework) whose benefits are recognizably greater but, alas, redound in the distant future. While middle and high school students say that academic work is more important to their personal futures than any other waking activity, they also experience it as dramatically less enjoyable (Galla, Duckworth, Rikoon, & Haimm, 2014). Likewise, holding one's temper in a heated argument and eating healthfully rather than snacking on junk food are more beneficial in the long-run than they are gratifying in the moment.

As we have defined it, self-control is an aspect of motivated behavior, a term which in its broadest sense encompasses all intentional, goal-directed behavior. The term "motivation" can also be used more specifically to refer to setting goals and evaluating their desirability and feasibility; when used in this narrower sense, motivation can be distinguished from volition (i.e., how effectively students strive toward their goals once they are committed to them) (Achtziger & Gollwitzer, 2008). This distinction is important because committing to goals does not guarantee subsequently taking steps toward their realization (Kuhl, 1984). For example, some students genuinely want to do well in school but are unable to autonomously regulate their behavior in ways that effectively advance them toward that aim (Corno & Mandinach, 2004; Zimmerman & Martinez-Pons, 1990). It is exactly this gap—between intention and striving—that interests us here.

A popular view of self-control equates the capacity to resist temptation with internal fortitude. Indeed, lay language—willpower, force of will, just do it, just say no—implies that we necessarily use a great deal of energy to suppress an undesirable impulse or elevate a desirable one. Accordingly, in the social psychology literature, the *ego depletion* model

suggests that resolving self-control conflicts exhausts a finite energy resource, leading to subsequent failures of self-control (Baumeister, 2014) and a subjective sense of strain (Inzlicht, Legault, & Teper, 2014; Kurzban, Duckworth, Kable, & Myers, 2013). Likewise, in the developmental literature, self-control is commonly referred to as *effortful control* (Rothbart & Rueda, 2005). Not surprisingly, much of the research on mechanisms of self-control has focused on top-down cognitive processes that inhibit lower-level impulses and support goal-directed behavior.

Whereas effortfully modulating responses in the heat of the moment is the most obvious way individuals exercise self-control, it may be the least effective. It turns out that even young children have less obvious but more artful means of manipulating their own behavior. For instance, preschoolers forgoing immediate gratification (e.g., one marshmallow) for larger, delayed rewards (e.g., two marshmallows) can wait significantly longer when they cover their eyes or stare at the ceiling, when the treats are hidden from view by an opaque cover, or when they imagine them to be fluffy, white, and inedible clouds (Carlson & Beck, 2009; Mischel, 2014). Outside of the laboratory, there are many more "tricks," as the economist Schelling (1984) put it, by which our future self can outmaneuver its myopic present self (p. 290).

The Process Model of Self-Control

We have recently proposed that self-control strategies—whether obvious or less obvious— can be organized according to their underlying mechanism and the stage at which they are employed (Duckworth, Gendler, & Gross, 2014). Specifically, the *process model of self-control* begins with the premise that impulses are response tendencies to think, feel, or act that develop over time. As shown in the bottom part of Figure 1, impulses come into being and either increase or decrease in intensity through a recursive situation-attention-appraisal-response sequence. Impulses of sufficient strength are enacted; those that fail to reach threshold are not. Often, impulses do not conflict. However, we sometimes experience conflicting impulses. When an immediately rewarding impulse is at odds with an impulse of greater value to us in the long-run, we need to intervene.

This conception of impulse generation suggests that five categories of self-control strategies can be identified, corresponding to distinct stages of impulse generation. These categories are shown in the top portion of Figure 1. To illustrate, consider a student who first encounters a particular situation (e.g., walks into his bedroom) and decides whether to modify it (e.g., turning off his cell phone). Next, he pays attention to particular features of the situation (e.g., looks at his textbooks), and appraises the situation (e.g., "I should get my homework out of the way before dinner") in a way that, finally, gives rise to the generation of an impulse (e.g., starting his homework). As we elaborate below, all strategies work by diminishing the strength of momentarily rewarding but ultimately undesirable impulses or, alternatively, amplifying the strength of enduringly beneficial but relatively less enjoyable ones. The most important prediction of the process model is that intervening earlier in the cycle of impulse generation, when impulses are still developing, is more effective than intervening later.

Situational strategies

Situation selection strategies are the most forward-looking and involve intentionally choosing to be in places or with people that facilitate self-control. For example, in a recent mixed-age focus group on academic success, we listened to a tenth grade student sagely advise a fifth grader in the same school: "If I knew at your age what I know now, I would have chosen different friends. Your friends really influence you. I got into the wrong crowd. It was really hard to get back on track." While direct empirical evidence on situation selection in adolescent students is lacking, it has recently been established that in adulthood, adults who are more self-controlled report intentionally avoiding situations replete with temptation (Ent, Baumeister, & Tice, 2015; Imhoff, Schmidt, & Gerstenberg, 2013). Relatedly, for drug addicts, encounters with trigger cues are perhaps the strongest predictor of recidivism, and treatment programs invariably advise deliberately avoiding people, places, and objects that induce craving (Bonson et al., 2002; Doyle, Friedmann, & Zywiak, 2013; Goldstein, 1994; Kelley, 2004; O'Brien, 1976; Osgood, Wilson, O'Malley, Bachman, & Johnston, 1996; Schroeder et al., 2001; Weiss, 2005).

As a practical matter, unfortunately, students cannot always transport themselves to different locations, nor can they easily "switch their friends," even if they know that doing so would help them realize their long-term goals. What else can students do? *Situation modification* strategies entail purposefully changing physical or social circumstances in ways that facilitate self-control. For example, adults eat less when using smaller plates and drink less when using taller, skinnier cups (Wansink, 2004; Wansink & Van Ittersum, 2003; Wansink, Van Ittersum, & Painter, 2006). Recovering alcoholics can take Antabuse to dissuade themselves from drinking (Banys, 1988). As early as six years old, children know that it is easier to resist treats when they are hidden from view (Mischel & Mischel, 1983). More relevant to the self-control problems of students, a few studies have linked situation modification with academic performance. In one study, college students who voluntarily self-imposed deadlines for long-term projects turned in better work than students who were able to turn in their work anytime during the semester (Ariely & Wertenbroch, 2002). Likewise, Zimmerman (1989) and Marcus (1988) found that successful students manipulate their environments (e.g., turned off the TV) to facilitate concentration.

Cognitive strategies

Next, there are three cognitive strategies, beginning with attentional deployment strategies. These entail directing our focus to features of the situation which strengthen desirable impulses or diminish undesirable impulses. Without direct tutelage, children learn this cognitive skill fairly early in life (Carlson & Beck, 2009; Peake, Hebl, & Mischel, 2002) but more recently, Sesame Street's Cookie Monster has been providing direct instruction. In one episode, after learning how to pronounce "delayed gratification," he models looking away from a cookie he is trying not to eat. "Me going to look away from cookie," he declares, turning his back. "Me not going to look at…" Soon, his attention is recaptured: Sniff, sniff. He turns to glance in the cookie's direction, then turns away again, underscoring that attention deployment is far from effortless: "Oooh! This hard! This hard for monster!" (PBS, 2013, September 4).

Once we have chosen where to place our attention, we can use *cognitive change* strategies to diminish our undesired impulses and amplify our desired ones. Cognitive change strategies entail thinking about our situation differently. For example, we can reappraise an argument by imagining ourselves as a third-party spectator to the conflict (Finkel, Slotter, Luchies, Walton, & Gross, 2013; White, Kross, & Duckworth, 2015) a technique called "going to the balcony" in the field of negotiations (Ury, 2007). It is likewise possible for preschool children to pretend that a marshmallow is "just a picture" and for for adults to mentally recast cigarettes as poison (Mischel, 2014). Still, it's not easy to change our thoughts. Indeed, while more effective than response modulation, intentionally changing the way we appraise our situation is far from effortless (Sheppes & Gross, 2011).

Of all the self-control strategies, *response modulation* is the most straightforward. In the "heat of the moment," we can voluntarily suppress an undesirable impulse (e.g., to reach for a cookie) or amplify a desirable one (e.g., to eat the apple that came with the school lunch). Unfortunately, the human capacity to exert cognitive control over goal-incongruent impulses is far from perfect. For example, hiding our emotions (e.g., trying not to cry when sad, or trying not to smile when amused) sometimes works but often doesn't, and even when successful, takes a physiological toll (Gross & Levenson, 1993). The cost of waiting until the last opportunity to modulate conflicting impulses is also phenomenological; it feels awful to deny oneself a momentary pleasure or to enforce an action whose benefits lie entirely in the distant future.

The Current Investigation

Given the importance of self-control to successful "studenting" (Corno & Mandinach, 2004) and other aspects of healthy development, two urgent unanswered questions concern the strategies that students use to navigate everyday self-control dilemmas and their relative effectiveness. The first question is descriptive and is concerned with whether the process model of self-control can organize students' diverse self-control efforts into theoretically coherent categories. The second question is normative and addresses the important question of which self-control tactics are most effective. The process model predicts that the earlier students attempt to turn the tide of their own conflicting impulses in favor of their long-term objectives, the better. As noted above, there is some empirical evidence supporting this supposition, but to date, research has focused on other age groups (e.g., preschool children, mature adults) or life domains (e.g., dieting, addiction, emotion regulation).

We focused our investigation on high school and college students, rather than younger learners, for several reasons. First, students are accorded increasing independence from parents, teachers, and other adults as they grow older (Steinberg, 2013). In tandem, brain areas subserving self-control mature with age (Carlson, Zelazo, & Faja, 2013), and generally, older students are more autonomous learners than younger students (Zimmerman & Martinez-Pons, 1990). It is therefore not surprising that relative to other personality traits and IQ, Big Five conscientiousness—which encompasses self-control and closely related traits (Eisenberg, Duckworth, Spinrad, & Valiente, 2014) —is more strongly related to academic performance in secondary and post-secondary schooling than in earlier grades (Poropat, 2009). Another reason for focusing on adolescents is that decisions and outcomes

during this transitional stage have long-term implications for adult development (Moffitt, et al., 2011).

We began with a naturalistic investigation of high school students (Study 1), who described self-control dilemmas they had experienced and told us how they dealt with them. We also asked students to indicate how they would respond to hypothetical scenarios in which the impulse to do academic work conflicted with diversions like texting or videogames. We expected that the majority of self-control attempts would be classifiable using the process model, that all five stages of the process model would be represented in their responses, and, further, that when asked to consider exemplar strategies, they would rate strategies deployed earlier in the process of impulse generation as more effective than those deployed later.

Next, in Study 2, we conducted a random-assignment field experiment to more confidently establish the relative effectiveness of earlier vs. later strategies. Specifically, we asked high school students to set a specific study goal for the following week and then instructed them to use either situation modification, response modulation, or no particular strategy at all. As noted above, we chose to examine situation modification rather than situation selection because we assumed that some students might not be able to choose their situations. As a comparison, we used the most obvious cognitive strategy: response modulation. In Study 3, we replicated these findings with college students and, in addition, tested the process model's prediction that undesirable impulses curtailed at the situation modification stage would be weaker than those countered at the response modulation stage.

Study 1: A Naturalistic Investigation of Self-Control Strategies

In Study 1, we asked high school students to describe incidents from their personal lives in which they needed self-control and, next, to indicate what they actually did. Prior research with middle school students suggests that self-control is called for primarily in the domains of academic work and interpersonal conflict (Tsukayama, Duckworth, & Kim, 2013), but we expected older students to grapple with additional dilemmas more common in adulthood (e.g., saving money, exercising) (Tsukayama, Duckworth, & Kim, 2012). Next, we asked students how they might handle three hypothetical academic self-control dilemmas (e.g., studying vs. playing videogames). To determine the utility of the process model for organizing self-control strategies for this age group, two trained coders classified these four open-ended responses according to the model's five categories. Finally, to test the prediction that early-deployed strategies are more effective than later-deployed strategies, we asked students to rate the effectiveness of specific responses to these three hypothetical scenarios, each designed to represent one of the model's categories.

Method

Participants—Participants were students from a suburban high school in the Northeast United States. This study was added to a survey of students enrolled in a foreign language course. Opt-in parental consent and student assent was obtained for $N = 577$ students enrolled in grades 9 through 12. Participants ranged in age from 13 to 19 years ($M = 15.49$, $SD = 1.13$). Approximately 70% of the students were White, 15% were Hispanic, 8% were

Black, 7% were Asian, 1% were of other ethnic backgrounds; 58% were female, and 14% were from low-income families, as indicated by eligibility for free or reduced-price meals.

Procedure and Measures—Students in grades 9 through 12 were asked to complete surveys in a single 45-minute session during the school day. In the first part of the session, they were asked to "tell a story of a specific incident where you used self-control when you really needed it. What were you trying to do and what actually happened? What did you try to do to be self-controlled in this situation?"

In the second part of the session, we described three common academic self-control dilemmas based on pilot interviews. These hypothetical scenarios were presented in random order, and each was followed by an open-ended question: "What would you do to get your studying done?" The texting scenario read: "You have set a goal of getting better grades this year than last year. Unfortunately, you're having difficulty staying focused on your studying for long periods of time because you keep texting with your friends." The Internet/ videogame scenario read: "You have to study for a big exam but the class is a really boring one. Every time you sit down to study, you find yourself tempted to surf the Internet (e.g., watch YouTube videos, check your Instagram feed, etc.) or play video games." And, finally, the procrastination scenario read: "You have a long-term project due and don't want to wait until the last minute to get it done. But there are a lot of more fun things to do, like playing video games and watching TV."

After telling us what they would do in these three hypothetical academic scenarios, students were asked to judge the effectiveness of self-control responses we provided that represented each of the five strategies defined by the process model of self-control. The instructions were as follows: "We've talked to a lot of other students about this situation. We find that five kinds of responses are really common. Now that you've seen these options, rate how effective you think each strategy would be for each of the three hypothetical scenarios on a scale from 0 to 100 (0 = *least effective*, 100 = *most effective*)". For example, students read and then rated five different approaches to the texting scenario corresponding to strategies in the process model. In this context, "I would move to a different location to avoid being near my phone" represented *situation selection*; "I would change something about my phone like turn off the volume or put it face down" represented *situation modification*; "I would not look directly at my phone. I would instead look directly at my academic work" represented *attentional deployment*; "I would change the way I think about this situation. For example, I would change the way I think about texting or change the way I think about the assignment" represented *cognitive change*; and "I would force myself not to use the phone. I would try to use willpower to overcome that urge" represented *response modulation*.

Data Analysis and Coding

Two trained coders categorized students' descriptions of self-control incidents in their own lives using domains (e.g., work, interpersonal conflict, eating, physical exercise) identified by Tsukayama, Duckworth, and Kim (2012). Less than 1% of responses could not be coded because they were blank or incomprehensible. The remaining valid responses were coded, and there were no disagreements on how to categorize dilemmas.

The same coders then categorized open-ended responses to this prompt according to the five strategy types in the process model of self-control (i.e., situation selection, situation modification, attentional deployment, cognitive change, and response modulation). About 4% of responses could not be categorized because they did not provide sufficient information, 2% indicated planning, but did not indicate what action was being planned, 2% of responses could not be classified because students said they failed to exercise self-control, and 2% were not categorized because they named a variety of strategies that spanned multiple categories in the process model. Coders concurred on how to categorize 81% of valid responses ($\kappa = .57$, $p < .001$) and, through discussion, arrived at a consensus for the remainder.

Likewise, the coders categorized open-ended responses to the three hypothetical academic self-control scenarios according to the five strategy types in the process model of self-control. About 6% of responses could not be coded because they did not provide sufficient information, 4% were not coded because they included strategies that spanned multiple categories in the process model, and 3% of responses could not be classified because they described failures of self-control. Coders concurred on how to categorize 87% of the valid responses ($\kappa = .58$, $p < .001$) and, through discussion, arrived at a consensus on the type of strategy used for the remainder.

Results

As illustrated in Table 1, students described a wide range of self-control incidents in their own lives. Most concerned interpersonal (42%) or academic (27%) situations; a smaller proportion of students described using self-control to regulate their eating (14%), physical exercise (6%), or behavior in sundry other (11%) domains. Age did not moderate these or any other analyses.

In response to these everyday dilemmas, students said they deployed a variety of strategies, examples of which are provided in Table 1. Notably, the majority (90%) of these open-ended responses could be categorized using the process model, and all five types of strategies were represented. They were not, however, equally popular, $\chi^2 (4, N = 522) = 135.99$, $p < .001$. As shown in Figure 2, the most commonly nominated strategy was cognitive change (38%), followed by response modulation (24%), situation modification (16%), situation selection (12%), and, finally, attentional deployment (10%).

Taking a closer look at the strategies nominated in the two most commonly described self-control dilemmas, we found that students used situation modification more often in academic situations (29%) than in interpersonal conflicts (6%), $\chi^2 (1, N = 371) = 37.28$, $p < .001$. Conversely, students relied on response modulation more often in interpersonal conflicts (35%) than they did in academic situations (17%), $\chi^2 (1, N = 371) = 13,42$, $p < .001$.

As shown in Figure 2 and Table 2, students likewise suggested a variety of strategies for exercising self-control in three hypothetical academic dilemmas. These hypothetical scenarios pitted academic goals against texting, videogames/Internet, and procrastinating, respectively. The majority (87%) of these responses could be categorized using process

model. Students were more likely to recommended situation modification strategies (58%) than cognitive change (17%), situation selection (12%), response modulation (11%), or attentional deployment (1%).

Considering that what students think they should do may differ from what they actually do, we took a closer look at ($n = 156$) students who elected to describe an everyday self-control incident that involved academic work (vs. interpersonal conflict, food, etc.). Comparing hypothetical and "real-world" everyday dilemmas in this subsample, we found no reliable differences in the popularity of situation selection strategies. Interestingly, students were *twice* as likely to suggest situation modification when recommending what to do in hypothetical academic scenarios (58%) than when describing what they actually did in similar situations (29%). In contrast, students used cognitive change more often in their everyday academic lives (32%) than they recommended doing in hypothetical scenarios (17%). Students used attentional deployment more often in their everyday academic lives (8%) than they recommended doing in hypothetical scenarios (1%). Finally, students recommended response modulation more often in hypothetical scenarios (28%) than they mentioned using it in their everyday academic lives (12%). One-sample nonparametric tests confirmed that these four comparisons were reliable, $ps < .001$.

When asked to rate the effectiveness of exemplar strategies from each of the five categories of the process model, students rated some strategies as much more effective than others. Effectiveness ratings were approximately normally distributed, with alphas ranging from .67 to .86 ($M = .79$). In a repeated measures ANOVA, effectiveness ratings varied by strategy type, $F(4, 2216) = 436.94$, $p < .001$, $\eta_p^2 = .44$. As illustrated in Figure 3, post-hoc pairwise comparisons using a Bonferroni correction showed that situation selection strategies were rated as more effective than situation modification strategies, $p < .001$, $d = .47$ which, in turn, were rated as more effective than attention deployment, cognitive change, or response modulation strategies ($ps < .001$ and ds from 1.05 to 1.23). The latter three strategies did not differ in student-rated effectiveness.

Discussion

To our knowledge, Study 1 is the first naturalistic study of self-control in the everyday lives of high school students. When asked about a self-control incident from their own recent experience, most students described managing interpersonal conflicts or meeting academic work responsibilities. The same domains have been identified as centrally important in the lives of middle school students (Tsukayama, et al., 2013), though some high school students in Study 1 mentioned self-control goals common in adulthood, including eating healthfully and getting physical exercise.

The process model proved a useful taxonomy for categorizing the many strategies that students used in the self-control incidents from their own lives. While some of the open-ended responses required discussion, most were agreed upon by two coders whose initial categorizations were made independently. Likewise, when considering three hypothetical academic scenarios, students recommended a heterogeneous array of strategies which, again, were mostly captured in the process model and were by no means limited to the most obvious tactic: response modulation. Interestingly, students used situation modification more

often to get their academic work done than to navigate interpersonal conflicts. This finding suggests that certain contexts lend themselves to particular self-control strategies, and that situation modification may be more apt for physical temptations (e.g., a computer or cell phone, either of which can be turned off) than emotional ones (e.g., losing one's temper at a classmate).

Because many students in our sample elected to tell us about an academic situation (as opposed to an interpersonal conflict or other type of situation) in which they recalled exercising self-control, we were able to use this subsample to compare "real world" strategies with those students suggested in response to hypothetical dilemmas. It turns out that when considering hypothetical academic scenarios, as opposed to recounting what they did in their own lives, students were more likely to suggest situation modification and less likely to suggest cognitive change, attentional deployment and response modulation strategies. This unexpected finding requires further research for a complete explanation. One possibility is that by explicitly mentioning physical temptations (e.g., cell phones) in the hypothetical scenarios, we biased students toward situation modification strategies (e.g., turning off the cell phone). Alternatively, it may be that when considering a hypothetical situation, students were able to think more objectively about how best to act. The later explanation is consistent with a large literature on construal level theory, which has established that mental representations of hypothetical (vs. actual) situations facilitate psychological distance, enabling proper consideration of their goal-relevant and essential features (Fujita, 2011; Fujita, Trope, Liberman, & Levin-Sagi, 2006).

When asked to consider self-control strategies that we constructed to represent the five stages in the process model, students overwhelmingly identified situation selection to be most effective, followed by situation modification. Rated far less effective than either of these two situational strategies were the later-deployed cognitive strategies. Notably, the absence of significant differences in the perceived effectiveness among the three cognitive strategies (i.e., attentional deployment, cognitive change, and response modulation) is at odds with empirical evidence that attentional deployment and cognitive change strategies are both more effective than response modulation (Mischel, 2014; Webb, Miles, & Sheeran, 2012). We discuss possible explanations in the General Discussion.

Study 2: A Self-Control Intervention Study in High School

The self-reported ratings of effectiveness provided by students in Study 1 support the most direct claim of the process model regarding the superior effectiveness of earlier deployed strategies. As a more rigorous test, we conducted Study 2, a field experiment with high school students. Consistent with our initial intuition that young people might lack the freedom to choose where and with whom they would be, students considering both real-life and hypothetical academic dilemmas in Study 1 nominated situation modification strategies at least twice as often as situation selection strategies. As a foil to situation modification, we considered the most obvious cognitive strategy: response modulation. We did so in part because there is a long tradition of admonishing students to "just pay attention!" or "just control yourself!" as an encouragement to their self-control. Thus, while the least sophisticated of cognitive self-control strategies, response modulation is also the most

straightforward. Accordingly, in Study 2, we randomly assigned students to implement either situation modification, response modulation, or no particular strategy in order to attain self-identified study goals. One week later, students in all three conditions reported the extent to which they had accomplished their goals and the general quality of their studying during the prior week.

Method

Participants—Participants were students attending a boarding high school in the Northeast United States. Opt-out parental consent and student assent were obtained for 250 students enrolled in grades 9 through 12, but half of students did not complete the follow-up survey. After confirming that attrition was not related to treatment condition, these students were excluded from further analyses, leaving a final sample of $N = 126$. Participants ranged in age from 14 to 19 ($M_{age} = 16.4$, $SD = 1.27$). About 58% were White, 24% Asian, 8% multi-racial, 6% African American, 3% of other ethnic backgrounds, and 1% Hispanic; 57% were female.

Procedure—Students were randomly assigned to one of three conditions: situation modification ($n = 44$), response modulation ($n = 35$), or no-treatment control ($n = 47$). All interventions were introduced as trying to help "students stick to study goals that they set for themselves."

All students were first asked to set a study goal that they would like to accomplish over the coming week. They were then asked to answer two questions about their study habits: "How many days over the past week did you study?" and "On average, how many hours per day did you study on the days that you studied last week?" At the end of the first session, all students provided demographic information and, in addition, were asked, "How much do you believe this strategy would work?" (1 = *do not believe at all* to 5 = *strongly believe*).

In the situation modification condition, students were instructed to remove temptations that might distract them from reaching an academic goal. Following a brief introduction, which introduced them to the idea of "removing temptations from sight rather than trying to resist them directly," they watched an animated video about relevant research. Specifically, students learned about a study in which secretaries ate less candy when candy was kept in bowls placed more than an arm's reach away (Wansink, Painter, & Lee, 2006). Next, they watched an expert endorse this strategy in a clip taken from a media interview (Duckworth, 2013, October 7). Finally, they were asked to modify their environment to minimize temptations (e.g., setting reminders or alarms, installing online apps to block online temptations such as Facebook). We emphasized that students should make any modification they thought would be useful and asked them to repeat any "temporary" changes (e.g., turning off the cell phone) as necessary.

Students assigned to the response modulation group were instructed to exert willpower whenever they were faced with temptation. Following a brief introduction, which introduced them to the idea that "people can actually strengthen their self-control muscle with repeated practice that consists of actively resisting immediate temptations (rather than simply avoiding them)," they watched an animated video about relevant research. Specifically,

students learned about a study in which individuals who practiced exerting willpower later exhibited increases in healthy eating, exercise, emotional control, and improvement in study habits (Oaten & Cheng, 2006). Next, they watched an expert endorse the concept of strengthening willpower in a media clip (McGonigal, 2012, July 22). Finally, they were asked to "practice resisting temptations when you encounter them." We emphasized that students should use willpower whenever they experienced an impulse to indulge in a temptation that conflicted with their academic goals.

In the no-treatment control condition, students were simply asked to set a study goal. They were not given any explicit information about how to achieve this goal.

One week later, all students were asked to report on their progress toward the goal they had previously identified. Students reported on the quality of their studying compared to prior weeks (*1 = a lot worse to 5 = a lot better*) and how well they felt they accomplished their goal (*1 = extremely poorly to 5 = extremely well*). As a manipulation check, they were also asked an open-ended question, "What strategies did you actually use to deal with temptations over the last week? Be as detailed as possible." Two trained coders categorized responses according to the five categories of the process model. About 14% of students did not answer this question, which was the very last part of the follow-up survey. An additional 7% could not be categorized because they did not provide sufficient information; 1% could not be categorized because students named a variety of strategies that spanned multiple categories in the process model. Coders disagreed about 2% of the remaining 98 valid responses and resolved these discrepancies through discussion.

Results

Preliminary analyses—Randomization was successful. There were no differences across condition in gender, age, or baseline study habits, nor did any of these variables moderate analyses. Therefore, these variables were not included in subsequent analyses.

We found a marginally significant effect of group on how much students believed their strategy would help them at baseline, $F(2,126) = 2.96$, $p = .06$, $\eta_p^2 = .05$. However, post hoc pairwise comparisons showed that anticipated helpfulness of the situation modification activity was not higher than either the response modulation activity or no-treatment condition, *ns*. Indeed, the only reliable pairwise difference was that the response modulation group ($M = 3.80$, $SD = 0.99$) believed in the helpfulness of their strategy more than the no-treatment group ($M = 3.26$, $SD = 1.05$), $p = .04$, $d = .50$. Including anticipated helpfulness as a covariate did not affect any results (results available upon request).

At follow-up, participants reported using different self-control strategies as a function of condition, $\chi^2(8, N = 98) = 20.8$, $p < .01$. Specifically, participants in the situation modification condition more frequently used situation modification strategies than participants in the response modulation, $\chi^2(1, N = 63) = 10.5$, $p < .001$, or no-treatment control conditions, $\chi^2(1, N = 71) = 15.85$, $p < .001$. Likewise, participants in the response modulation condition used response modulation more frequently than participants in the situation modification condition, $\chi^2(1, N = 63) = 5.22$, $p = .02$. Reported use of response

modulation strategies in the response modulation condition did not significantly differ from the no-treatment control condition, $\chi^2(1, N = 62) = 0.88$, $p = .35$.

Primary analyses—We first ran a one-way ANOVA to compare students' goal accomplishment across conditions (situation modification, response modulation, no-treatment control). As illustrated in Figure 4a, there was a significant effect of condition on goal accomplishment, Welch $F(2, 73.24) = 4.35$, $p = .016$, $\eta_p^2 = .06$. Planned contrasts accounting for unequal variances revealed that students in the situation modification condition ($M = 3.39$, $SD = 0.83$) better accomplished their goals than students in other conditions (response modulation control: $M = 2.86$, $SD = 1.14$; no-treatment control: $M = 2.91$, $SD = 0.85$), $t(90.72) = 2.91$, $p < .01$, $d = 0.56$. The no-treatment control and response modulation control conditions did not differ from one another, $t(60.81) = -0.23$, $p = .82$.

Similarly, a one-way ANOVA revealed that study quality also differed by condition, $F(2, 119) = 5.49$, $p < .01$, $\eta_p^2 = .08$ (see Figure 4b). Planned contrasts confirmed that students in the situation modification condition ($M = 3.34$, $SD = 0.79$) reported better study quality than students in other conditions (response modulation control: $M = 3.00$, $SD = 0.77$; no-treatment control: $M = 2.76$, $SD = 0.87$), $t(119) = 2.93$, $p < .01$, $d = 0.57$. The no-treatment control and response modulation control conditions did not differ from one another, $t(119) = 1.30$, $p = .20$.

Discussion

The experimental findings in Study 2 were consistent with our naturalistic investigation in Study 1. Specifically, high school students randomly assigned to implement situation modification were better able to accomplish their study goals the following week and, in addition, reported their studying that week to be higher in quality than students randomly assigned to implement response modulation or no particular strategy. These differences were large in size and reliable, whereas there were no reliable differences between the response modulation and no-treatment conditions.

Study 3: A Self-Control Intervention Study in College

In Study 3, we sought to replicate the findings of Study 2 in a sample of college students and, further, test the hypothesis that situation modification would diminish the aversive feelings of temptation associated with directly modulating impulses. By doing so, we tested the prediction that impulses addressed earlier in their gestation would be weaker than those addressed later. While we bore no illusions that manipulating the physical surroundings would make studying especially pleasurable, we did imagine it might make it relatively *less* unpleasant. We conjectured that reduced feelings of temptation might, therefore, mediate the effects of situation modification on goal attainment.

Method

Participants—Participants were undergraduate students recruited from psychology courses at the University of Pennsylvania. A sample of $N = 159$ students ($M_{age} = 20.4$, $SD = 1.09$) completed all study requirements and received course credit for completing the survey.

Participants were 54% Caucasian, 25% Asian, 8% of other ethnic backgrounds, 7% Hispanic, and 6% African American; 65% were female.

Procedure—Students were randomly assigned to one of three conditions: situation modification ($n = 52$), response modulation ($n = 52$), or no-treatment control ($n = 55$). Similar to Study 2, all interventions were introduced as trying to help "students stick to study goals that they set for themselves."

The instructions and activities for the three conditions were similar to those used in Study 2. Students were asked one question about their study habits: "On average, how many hours do you study per day?" All students were also asked to set a study goal that they would like to accomplish over the coming week. One important difference is that participants in the situation modification condition used their cell phone cameras to document changes to their environment, a manipulation check we were not able to apply in Study 2 given the younger age and associated confidentiality concerns of those participants.

One week later, all students were asked to report on their progress toward their goal. Specifically, they reported how well they felt they accomplished their goal (*1 = extremely poorly to 5 = extremely well*), and how tempted they felt by distractions in their environment over the past week (*1 = not at all tempted to 5 = extremely tempted*). Finally, we asked students to complete a checklist of five strategies, indicating any and all they had used in the past week. The five strategies were described without naming them categorically. For example, students who indicated they had "changed my surroundings so that the temptation was out of reach or not easily accessible" were considered having used situation modification. Students who indicated, "I told myself, I will not give in to temptation" were considered having used response modulation.

Results

Preliminary analyses—There were no differences across condition in gender, or age, and these variables did not moderate any of the subsequent analyses.

However, there was a significant effect of group on the number of hours studied per day at baseline, $F(2, 161) = 6.44$, $p < .01$, $\eta_p^2 = 0.07$. Pairwise comparisons showed that the response modulation group ($M = 4.13$, $SD = 1.67$) studied more than the situation modification group ($M = 3.04$, $SD = 1.60$), $p < .001$, $d = 0.70$. There were no differences between either situation modification or response modulation and the no-treatment group ($M = 3.54$, $SD = 1.48$), ps $< .15$. Given these differences at baseline, hours studied was included as a covariate in subsequent analyses.

As a manipulation check, we fit two binary logistic regression models predicting use of situation modification and response modulation strategies, respectively, from condition and controlling for hours studied. As expected, participants in the situation modification condition were more likely to use situation modification strategies than participants in the response modulation condition, Wald = 7.53, $p < .01$, or the no-treatment control condition, Wald = 7.53, $p < .01$. Relative to the response modulation group, participants in the no-treatment control group were equally likely to use response modulation strategies, Wald =

1.03, $p = .31$, but participants in the situation modification condition were marginally less likely to use response modulation, Wald = 2.62, $p = .10$.

Primary analyses—A one-way ANCOVA revealed that students' success at achieving their goals differed by condition, $F(2, 155) = 6.48$, $p < .01$, $\eta_p^2 = .08$. As shown in Figure 5a, pairwise comparisons revealed that participants in the situation modification group ($M = 3.56$, $SD = 1.05$) accomplished their goal more often than participants in either the response modulation ($M = 3.06$, $SD = 1.04$), $p < .01$, $d = 0.60$, or the no-treatment group ($M = 2.98$, $SD = 1.13$), $p < .01$, $d = 0.63$. The response modulation group, however, did not differ from the no-treatment group, $p = .97$, $d = 0.01$.

Similarly, a separate one-way ANCOVA showed that the level of temptation students faced over the previous week ($M = 3.77$, $SD = .85$) also differed by condition, $F(2, 155) = 5.44$, $p < .01$, $\eta_p^2 = .07$ (Figure 5b). Participants in the situation modification group ($M = 3.46$, $SD = 0.83$) reported having experienced less temptation over the previous week than participants in either the response modulation group ($M = 3.97$, $SD = 0.83$), $p < .01$, $d = 0.61$, or the no-treatment control group ($M = 3.87$, $SD = 0.82$), $p < .01$, $d = 0.50$, but the response modulation group was not significantly different from the no-treatment group, $p = .54$, $d = 0.12$.

Finally, in order to test the hypothesis that situation modification could increase self-reported goal attainment, at least in part, by reducing temptation, we used Hayes and Preacher's (2014) Mediate Macro for SPSS to test whether self-report of overall temptation mediated the effect of condition on goal accomplishment. Two dummy codes were created for the two treatment groups (coded as 1) with the no-treatment group serving as the reference group (coded as 0). We found that temptation partially mediated goal accomplishment for the situation modification group (indirect effect = 0.22; 95% bootstrapped confidence interval, CI: [0.05, 0.43]), but not for the response modulation group (indirect effect = −0.05; 95% bootstrapped confidence interval, CI: [−0.22, 0.10]), relative to the no-treatment condition (see Figure 6). This supports our hypothesis that situation modification may be an effective self-control strategy partly because it reduces the degree to which participants felt tempted when trying to accomplish their goals during the week.

Discussion

Study 3 confirmed the findings of Study 2. College students encouraged to change their physical surroundings in ways that would help them achieve their study goals were more successful in actually accomplishing these goals in the following week. As predicted by the process model, they reported having experienced less temptation during the same period, and reduced feelings of temptation partially mediated the effect of condition on self-reported goal attainment.

The contribution of Study 3 to the overall investigation was several-fold. First, the effect of condition on study goal attainment replicated findings of Study 2, strengthening the inference that situation modification strategies are more effective than response modulation strategies. Second, the mediation results supported the process model insofar as they

indicated that students who used situation modification strategies were able to curtail the strengthening of undesirable impulses, compared to students who used response modulation strategies or no particular assigned self-control strategy. While strong claims about the mediational role of temptation are inappropriate given our study design (Bullock, Green, & Ha, 2010), we are encouraged by this preliminary evidence to more rigorously test the extent to which situation modification makes self-control "easier." Third, whereas Study 1 and Study 2 involved high school students, Study 3 involved college students, thus extending the external validity of our investigation to older students accorded relatively greater autonomy in their everyday decision making.

General Discussion

Across three studies, we examined how high school and college students exercise self-control and assessed the relative efficacy of their efforts to do so. In Study 1, we found that high school students use self-control in a variety of everyday situations but most commonly to navigate interpersonal conflicts and to get their academic work done. When asked how they handled these incidents, students named strategies which could be reliably classified using the process model of self-control. In response to three hypothetical academic scenarios (e.g., studying vs. texting friends), students likewise suggested diverse means of exerting self-control, but when asked to consider strategies we had written to represent each of the five strategy types in the process model, they overwhelmingly rated situation selection as most effective, followed by situation modification, and finally all three later-deployed cognitive strategies (i.e., attentional deployment, cognitive change, and response modulation).

We were surprised that students judged response modulation to be as effective as attentional deployment and cognitive change strategies. This finding is at odds with theoretical predictions from the process model as well as empirical research showing that preschoolers encouraged to direct attention away from tempting treats or to think about them in "cooler," less consummatory terms, are better able to delay gratification (Mischel, 2014; Mischel et al., 1989). One possibility is that young children benefit more from these more sophisticated cognitive strategies than do adolescents, but this explanation is hard to square with evidence that adults more effectively regulate their emotion when using cognitive change than when using response modulation (Gross, 2014). Alternatively, differences in effectiveness among these later-deployed strategies might be real but too small in size for students in our study to recognize. Relatedly, it may be that any of these cognitive strategies is more easily reversed than situational strategies, and therefore comparably less effective. For example, when trying to study rather than spend time on social media, students might look away or mentally recast that pastime as a threat to their grade point average—but, alas, it is just as easy to glance back, or to think instead about how many "likes" you've garnered in the last few minutes. In contrast, it takes effort to reverse the decision to close the Internet browser, shut down the laptop, or find a distraction-free room in which to study. All of these possibilities merit further investigation.

In Studies 2 and 3, high school and college students randomly assigned to implement situation modification strategies reported being better able to accomplish their study goals

the following week than were students assigned to implement response modulation or given no explicit self-control strategy at all. We found evidence in Study 3 that reduced feelings of temptation partially mediated the effect of condition on goal attainment. These experimental results suggest that students might benefit from direct instruction in modifying their situations to advantage. Perhaps the activity we developed merely reminded them of the helpfulness of situation modification. If so, one can imagine that a comparable benefit might be realized if the content included in our intervention was shared with students. For example, instead of simply exhorting students to rely on their willpower, teachers and professors might instead explain that removing temptations from their surroundings makes staying on task easier.

Collectively, these findings suggest that intervening early in the development of an impulse may be more effective than intervening later. Probing how students think about various self-control tactics, we discovered that they largely recognize that when it comes to self-control, a stitch in time saves nine. In particular, when presented with hypothetical academic self-control dilemmas, they recommended situation modification more than any other strategy. However, situation modification was mentioned less than twice as often when students told us what they did to manage their academic responsibilities in their own everyday lives. Given how much more effective students rated situation modification than any cognitive strategy ($ds > 1$), an intriguing possibility, to be pursued in further research, is that students already recognize what they "should" do to effectively exercise self-control but do not always act accordingly.

Limitations and Future Directions

The current investigation had several limitations that should be addressed in future research. Most importantly, in the interventions presented in Studies 2 and 3, we relied upon self-reported, rather than behavioral, measures of goal attainment. We did so in order to allow students to set personally relevant and feasible academic goals. As expected, these goals were extremely diverse: some students resolved to "finish all of [their] homework the day before it is due," others aimed to "study French for one hour each night before [they] sleep, and still others hoped to "not go on Facebook while completing [their] research paper." Using self-reported outcomes made it possible to tailor our assessments to each participant's goals. However, our reliance on self-reported outcomes means that demand effects may have contributed to the superior efficacy of the situation modification activity. We think this is unlikely, given that Study 2 participants in the situation modification condition, at baseline, rated their activity as no different in helpfulness than students in the other two conditions. (Unfortunately, no such manipulation check was administered in Study 3.) Nonetheless, one important direction for future research is to replicate and extend present findings using behavioral outcomes.

Relatedly, participants in Studies 2 and 3 reported on their goal attainment during the prior week using single-item questions. Measurement error on predictor variables inflates standard errors. Thus, longer multi-item questionnaires of goal attainment, rather than single-item measures thereof, might have provided more precise estimates of the benefits of situation modification across these two studies.

Future research is also needed to determine the durability of situation modification interventions. We documented large-sized effects on attainment of study goals one week later, but we did not measure the effects of our manipulation beyond that time point. Common sense suggests that an intervention lasting less than half an hour would soon be forgotten or displaced by prior habits, but recent research on "psychologically wise" interventions pinpointing theoretically precise targets has shown enduring effects of very brief interventions on academic outcomes (Walton, 2014; Yeager & Walton, 2011). Such interventions seem to work, at least in part, by changing a recursive process (e.g., improving behavior, leading to improvements in outcomes, thereby reinforcing motivation to continue improving behavior). The mediation results in Study 3 give us some hope for just such a possibility. In particular, we speculate that students who change their situations to their advantage experience less temptation as a result, which helps them accomplish their study goals, leading to better academic performance, and reinforcing their motivation to continue modifying their situations. Longitudinal experiments with a more extended time frame are needed to test this possibility.

Finally, the random-assignment experiments in Studies 2 and 3 contrasted situation modification and response modulation as exemplar earlier vs. later self-control strategies. A complete test of the process model would ideally entail a simultaneous comparison of all five self-control strategies and a no-treatment control. With adequate statistical power, such a study design could unambiguously establish the efficacy of strategies as a function of the stage in process of impulse generation at which they are deployed.

Conclusion

The current investigation reveals high school and college students to have in their arsenals many more means of exercising self-control than direct effortful inhibition of undesirable impulses. Unfortunately, while they seem to recognize the utility of choosing where and with whom to be, and subsequently modifying these physical and social circumstances to advantage, they do not always do so. Why not? Perhaps students lack the future orientation to spontaneously anticipate temptations far enough in advance to take appropriate preemptive measures. Or perhaps they assume that the inherently cognitive conflict between conflicting impulses should be resolved with similarly cognitive tactics. In other words, remedies that are qualitatively different from the problem itself are, perhaps, less obvious, even if they are ultimately more effective. Given the importance of self-control to success in school and beyond, the questions raised by our current findings bear special urgency. Why don't students capitalize on forward-looking, situational solutions to self-control dilemmas? What "psychologically wise" interventions might equip them with these skills? How might this broadened conception of what it means to exercise self-control benefit "studenting" and other life responsibilities? Answers to these questions promise both theoretical insights and practical tools for managing the many self-control dilemmas that characterize the human condition.

Acknowledgments

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SITUATIONAL STRATEGIES   **COGNITIVE STRATEGIES**
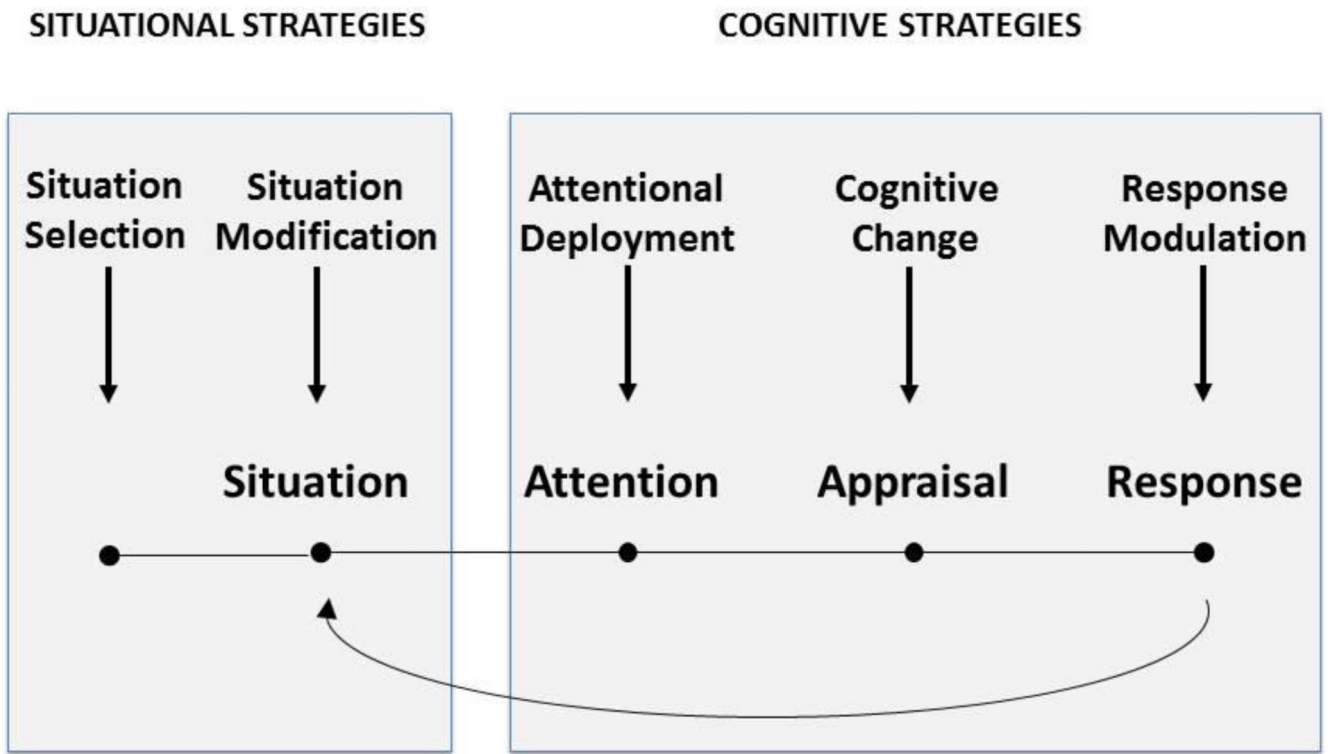
Figure 1.
The process model of self-control (adapted from Duckworth, Gendler, and Gross (2014).
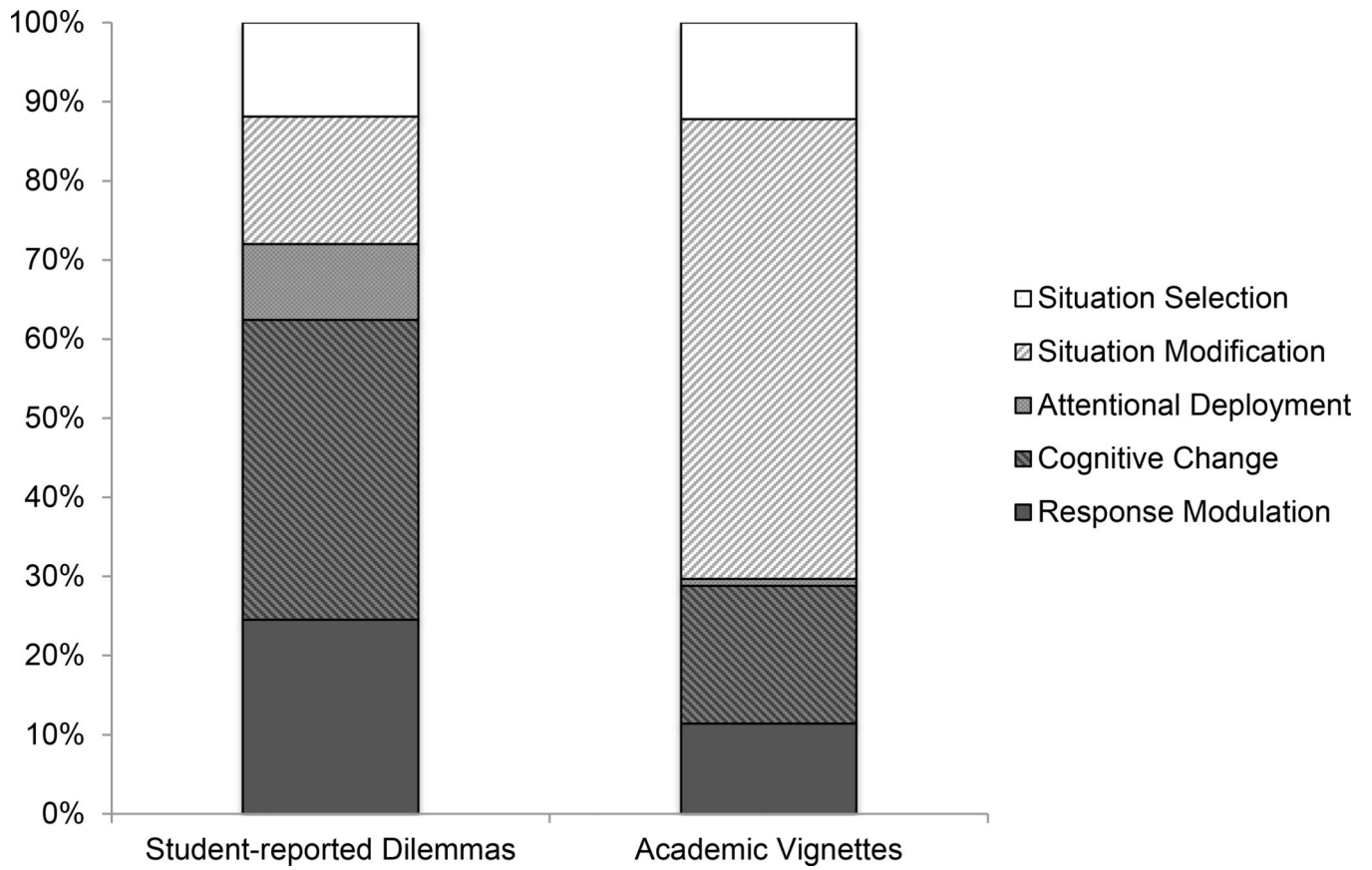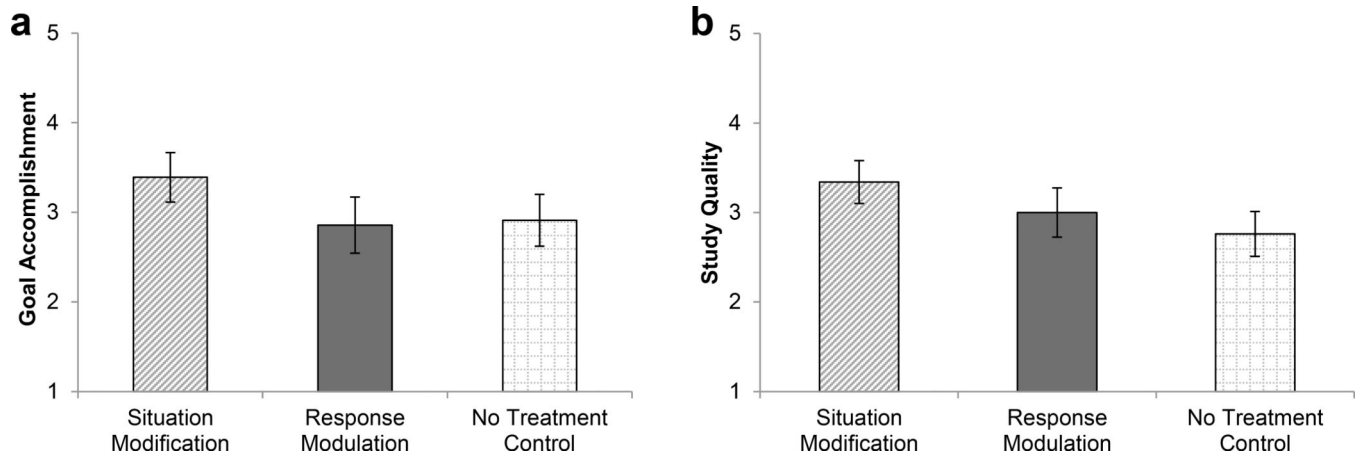
Figure 2.
Categories of self-control strategies suggested by high school students in Study 1.
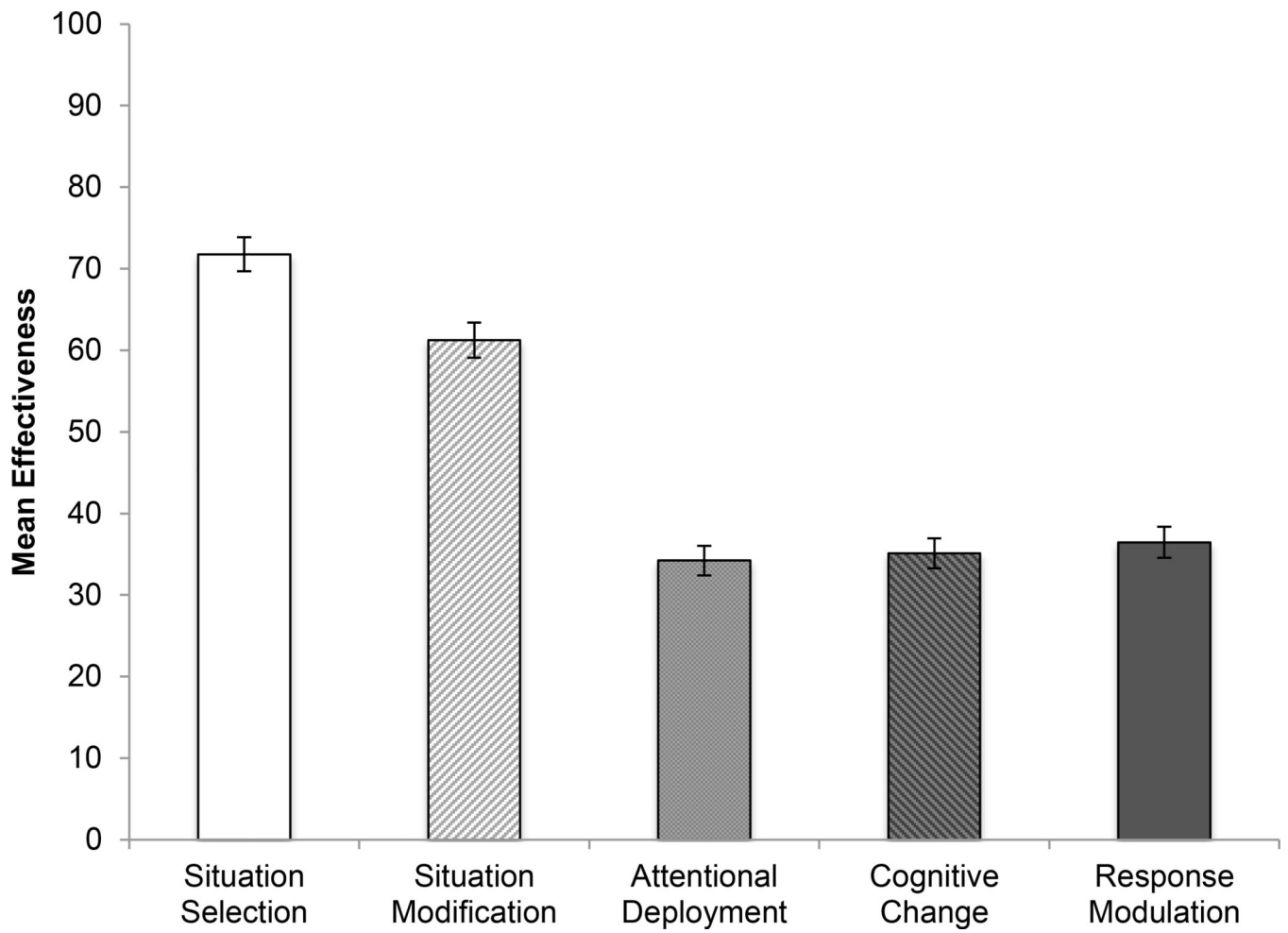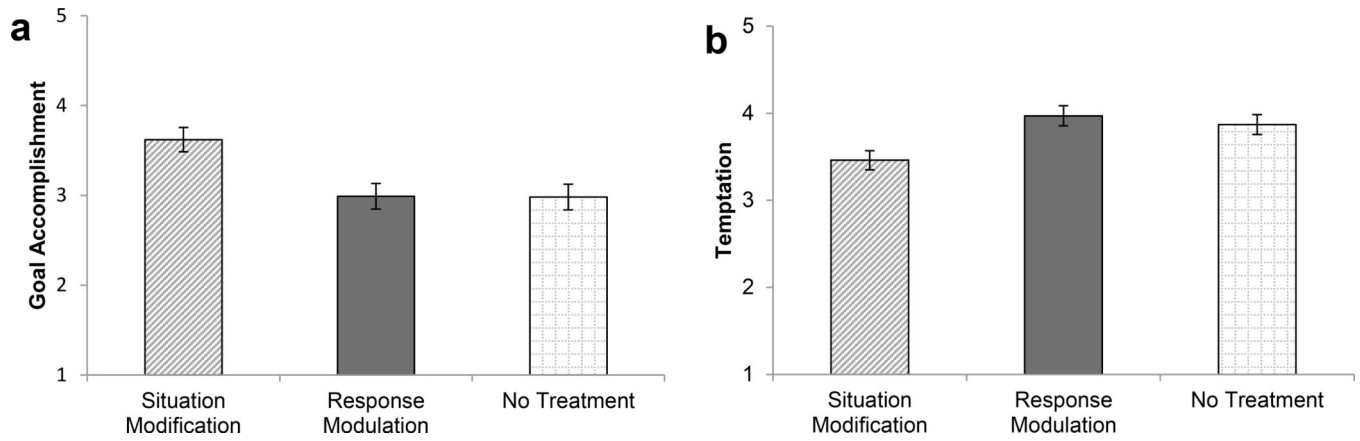
Figure 3.
Mean effectiveness ratings of example self-control strategies by high school students in Study 1.
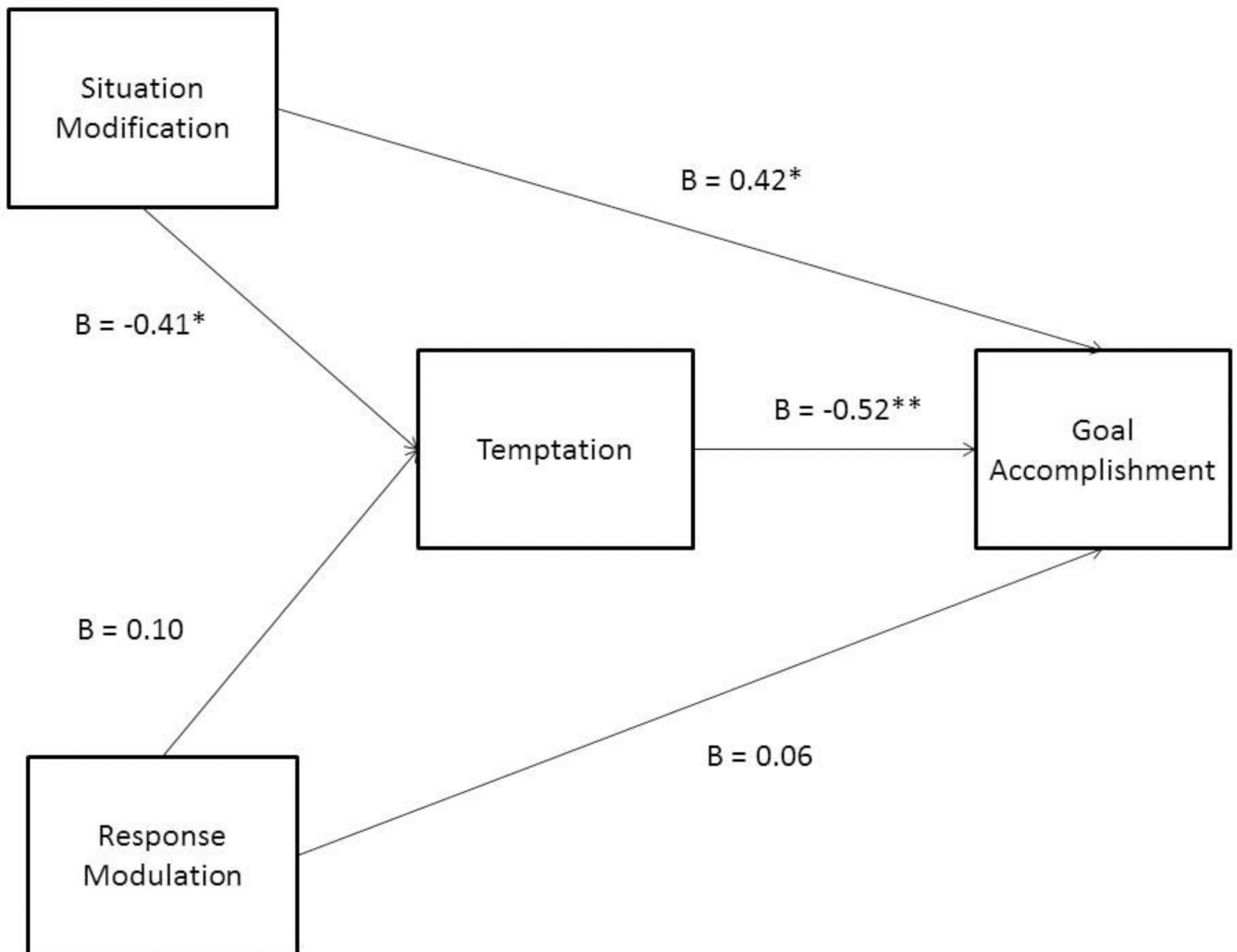*Note.* Error bars represent 95% CI.

Figure 4.
High school students' ratings of (a) goal accomplishment and (b) study quality in Study 2.

Note. Error bars represent 95% CI.

Figure 5.
College students' ratings of (a) goal accomplishment and (b) level of temptation in Study 3.
Note. Estimated marginal means controlling for number of hours studied at baseline. Error bars represent 95% CI.

Figure 6.
The effect of condition on goal accomplishment is partially mediated by temptation experienced by college students in Study 3.
Note. The coefficients shown are unstandardized. Condition effects are relative to control (dummy coded as 0). *p < .05, **p < .001.

Table 1

Examples of Self-Control Challenges and Responses in the Everyday Lives of High School Students in Study 1

Type of Strategy	Self-Control Challenge	Self-Control Response
Situation Selection	"I really needed to study for a test and I used self-control to resist taking a nap and playing on my phone to study."	"I locked myself in my room without my phone and sat in a desk so I couldn't fall asleep."
Situation Modification	"I knew I needed to study to get a good grade because I needed the A."	"I put away all devices that hindered my ability to focus on my task."
Attentional Deployment	"At around 6pm I start to get hungry. Knowing that dinner is around 7, I use self-control to stay away from snacks for that hour. I do this so I still have an appetite for dinner."	"I occupied myself with other activities."
Cognitive Change	"When doing homework I usually get lazy and go on to doing other useless things. Lately, I have been using self-control to focus on homework. "	"I simply laid out the cons of what would happen if I didn't do my homework, and was motivated to do it."
Response Modulation	"I was in a soccer game and a kid continuously fouled me and was harassing me."	"Instead of retaliating, I used self-control and controlled my anger and the kid eventually got a yellow card."

Table 2

Examples of Responses to Hypothetical Academic Self-Control Challenges by High School Students in Study 1

Type of Strategy	Studying vs. Texting	Studying vs. Internet/Videogames	Procrastination
Situation Selection	"Lock myself in a room without my phone so that it doesn't become a distraction."	"I would go to the library as being in a quiet and controlled environment would make me focus."	"Lock myself in my room until it's done, because I don't have a T.V. let alone a game console in my room."
Situation Modification	"I would shut off my phone and put it under my pillow so I wouldn't be tempted to touch it."	"Remove all distractions and tell one of my parents I had a big exam so they would check in on me and I'd be forced to stay on task."	"I would ask my mom to take away my phone and other distractions to make sure I can get it done on time."
Attentional Deployment	"Ease off the texting by ignoring my phone."	"Remind myself that even the most boring classes count towards my GPA which will affect my future."	"Think about the consequences and try my best to close everything else out"
Cognitive Change	"I would set up a reward for myself… I would plan something for myself that I would only do if I got straight A's."	"I would tell myself that if I study for an hour, I can reward myself by playing video games later."	"Set goals, break the project up into pieces."
Response Modulation	"Not be a baby and just study."	"Just deal with it and study."	"Just do it…I just focus and get my work done."