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A Motivation Treatment to Enhance Goal Engagement in Online Learning Environments: Assisting Failure-Prone College Students With Low Optimism

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Motivation treatments to enhance goal engagement can improve academic outcomes for college students with single academic risk factors (Hamm, Perry, Chipperfield, Heckhausen, & Parker, 2016), but their efficacy remains unexamined for students with multiple risk factors in online learning environments. In a pre-post, randomized treatment study (n = 628), a theory-based goal engagement treatment (Heckhausen, Wrosch, & Schulz, 2010) was administered online to college students who varied in high school grades (HSG; low, high) and optimism (low, high). For students with co-occurring risk factors (low HSG–low optimism), the goal engagement treatment (vs. no-treatment) improved performance by a full letter grade on three posttreatment class tests in a two-semester course. The treatment also increased the odds of two-semester course completion by 89% for low HSG–low optimism students. Findings advance the literature in showing that a scalable and theory-based goal engagement treatment can assist college students with multiple academic risk factors.

Keywords: motivation treatment interventions, goal engagement, primary and secondary control, optimism, academic risk factors

Life course transitions occur throughout human development and are characterized by challenge and uncertainty, as when entering a new school, starting a career, having a first child, or retiring (Heckhausen, 1997; Heckhausen, Wrosch, & Schulz, 2010; Perry, 2003). An exemplar of these shifts, the school-to-college transition exposes first-year students to unfamiliar and competitive learning environments, more frequent failures, financial demands, unstable social networks, and critical career choices (Perry, 2003; Perry, Hall, & Ruthig, 2005). These challenges have the capacity to undermine student motivation and goal engagement. For instance, data from the U.S. Department of Education show nearly 30% of college students drop out within their first year and less than 60% graduate after 6 years (Snyder & Dillow, 2013).

Academic risk factors can exacerbate the challenges inherent in school-to-college transitions and are implicated in poor student performance and persistence during this juncture (Parker, Perry, Chipperfield, Hamm, & Pekrun,

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2018; Perry, 2003; Perry, Hall, et al., 2005). Low high school grades (HSGs) represent one of the most influential academic risk factors (see Mathiasen, 1984; Mouw & Khanna, 1993; and Robbins, Lauver, Le, Davis, Langley, & Carlstrom, 2004). HSGs have been classified as a traditional risk factor that reflects a combination of students' academic skills and abilities, work habits, and content knowledge (Hamm et al., 2016; Richardson, Abraham, & Bond, 2012; Schneider & Preckel, 2017).

Meta-analyses by Richardson et al. (2012) and Robbins et al. (2004) showed that HSGs were the strongest traditional correlate of college grade point averages (rs = .40 to .41) and predicted performance as well or better than SAT (rs = .29 to .37) or ACT scores (rs = .37 to .40). HSGs are also a strong predictor of whether students persist in their academic programs and complete their degrees. A study of 1,500 college students showed that each one-unit increase in HSGs (0.0 = F to 4.0 = A) predicted nearly a threefold increase in the odds of 5-year graduation (Johnson, 2008). These findings suggest that students who enter college with low HSGs are at elevated risk of academic failure.

Low HSGs do not exist in isolation, but as one among many academic risk factors. For example, low optimism is a psychological risk factor defined by a stable, generalized expectancy that one will experience negative outcomes (Carver & Scheier, 2014; Scheier & Carver, 1985). The motivational theory of life-span development proposes that individual differences in optimism may have significant implications for motivation and goal engagement (Heckhausen & Wrosch, 2016; see also Heckhausen et al., 2010). Specifically, optimism is theorized to serve as a psychological resource that sustains goal engagement when individuals encounter challenging obstacles during goal pursuit (Heckhausen & Wrosch, 2016). This implies low optimism reflects an academic risk factor that can undermine goal engagement and other motivational resources when they are most needed, such as when students face difficult setbacks and failures.

Past studies of college students are consistent with this premise and have shown low optimism is associated with maladaptive affective states that erode motivation, including increased perceived stress, hopelessness, and depressive symptoms (Ruthig, Perry, Hall, & Hladkyj, 2004; Scheier & Carver, 1985). Low optimism is also related to maladaptive cognitive states, such as diminished grade goals, perceived success, and perceived control (Geers, Wellman, & Lassiter, 2009; Haynes, Ruthig, Perry, Stupnisky, & Hall, 2006; Nes, Evans, & Segerstrom, 2009; Ruthig, Haynes, Stupnisky, & Perry, 2009). Research by Geers et al. (2009) found that students with low optimism had difficulty self-regulating their academic behaviors, struggled to balance multiple goals, and failed to prioritize those goals that were most important. Longitudinal field studies show that low optimism can undermine students' perseverance in academic and career pursuits: Those with low optimism were less committed to their educational institutions, less likely to complete their first year of college, and earned less income 10 years later (Barkhuizen, Rothmann, & van de Vijver, 2014; Nes et al., 2009; Segerstrom, 2007).

Taken together, research suggests students with co-occurring risk factors involving low HSGs and low optimism face significant academic obstacles and may struggle to maintain their motivation during the school-to-college shift. These students may benefit from motivation treatments designed to sustain goal engagement during difficult transitions in achievement settings. Initial evidence suggests that when goal engagement treatments are delivered in controlled laboratory settings, they improve academic performance for college students with single risk factors (Hamm et al., 2016). However, research has yet to examine whether goal engagement treatments can assist students with multiple risk factors when delivered in online learning environments. Our two-semester, pre-post, randomized treatment field study thus examined the efficacy of an online goal engagement treatment to increase performance and persistence for students with co-occurring risk factors involving low HSGs and low optimism.

The Benefits of Goal Engagement During Life Course Transitions

The present goal engagement treatment was based on the motivational theory of life-span development (Heckhausen et al., 1995, 2010; Schulz & Heckhausen, 1996). Heckhausen and colleagues posit that active goal engagement commonly involves selective primary and selective secondary control processes. *Selective primary control* (SPC) refers to the use of behavioral strategies to pursue valued goals (e.g., invest time, effort, skills into one's education). *Selective secondary control* (SSC) refers to the use of self-regulatory strategies to sustain motivational commitment to chosen goals (e.g., reminding oneself of how important a good education is to one's future, thinking about the pride one will experience after goal attainment). We distinguish these control strategies based on the resources they target hereafter. SPC strategies are thus referred to as *behavioral*, and SSC strategies are referred to as *self-regulatory*.[1]

Consistent evidence has documented the benefits of goal engagement across domains and throughout the life-span. Past studies have shown goal engagement is associated with better college performance, the attainment of career goals, higher job and life satisfaction, increased perceived control, more positive affect, increased life purpose, less depressive symptoms, fewer physical health conditions, better functional status, and reduced mortality risk (Chipperfield, Perry, & Menec, 1999; Chipperfield & Perry, 2006; Haase, Heckhausen, & Köller, 2008; Haase, Heckhausen, & Silbereisen, 2012; Hall, Chipperfield, Heckhausen, & Perry, 2010; Hamm et al., 2016, 2017; Haynes, Heckhausen, Chipperfield, Perry, & Newall, 2009; Shane & Heckhausen, 2016).

Central to the present study is research that shows goal engagement focused on self-regulatory SSC strategies fosters adaptation for youth and young adults during major life course transitions. For example, Poulin and Heckhausen (2007) found that SSC benefited adolescents shifting from school to work: Increased use of self-regulatory SSC strategies were positively related to behavioral SPC ($r = .60$), perceived control ($r = .57$), and positive affect ($r = .30$) over a 10-month period. SSC benefits were most pronounced for adolescents who experienced stressful life events, such as parental divorce or death of a family member.

Several longitudinal field studies extended this research by examining the correlates and consequences of self-regulatory SSC strategies for young adults during school-to-college transitions (Hamm et al., 2013, 2015, 2016). A reliable pattern emerged across these studies, as SSC facilitated behavioral SPC over periods of up to five months ($rs = .55–.61$). Use of self-regulatory SSC strategies also predicted improved two-semester academic performance (final course grades), adaptive achievement emotions (more happiness, pride, hope; and less guilt, regret, helplessness, shame, anger), and psychological and physical well-being (less depressive and stress-related physical symptoms). In line with theory (Heckhausen et al., 2010), SSC benefits were most pronounced for failure-prone students who faced additional obstacles to academic goal attainment (those with low HSGs).

Goal Engagement Treatments for Young Adults in Transition

Despite the potential of goal engagement treatments to sustain motivation during difficult life course transitions, few studies have examined their efficacy for young adults who shift from school to college. Initial research by Hamm et al. (2016) administered a goal engagement treatment targeting SSC processes to college students in a controlled laboratory setting. Results showed the treatment improved year-end academic performance by a letter grade (C+ vs. B) for students with a single risk factor. Treatment effects on performance were mediated by a sequence of psychological mechanisms consistent with theory (Heckhausen et al., 2010). The goal engagement treatment (vs. no-treatment) promoted goal engagement, which enhanced positive emotion and diminished negative emotion, and these in turn predicted year-

[1] The present literature review focuses on goal engagement from the perspective of the motivational theory of life-span development. It therefore does not address motivation treatments that involve motivation theories other than Heckhausen et al.'s (2010); are not based on goal engagement strategies, for example, attributional retraining (e.g., Perry & Hamm, 2017), value enhancement (e.g., Harackiewicz, Rozek, Hulleman, & Hyde, 2012; Hulleman & Harackiewicz, 2009), intention implementation (e.g., Duckworth, Grant, Loew, Oettingen, & Gollwitzer, 2011), goal setting (e.g., Morisano, Hirsh, Peterson, Pihl, & Shore, 2010), growth mindset (e.g., Paunesku et al., 2015), or social belonging (e.g., Walton & Cohen, 2011); do not focus on motivation or performance outcomes (e.g., psychotherapy); or target very young or old populations (e.g., Chapin & Dyck, 1976; Gitlin, Hauck, Winter, Dennis, & Schulz, 2006). Reviews of the broader motivation treatment literature are provided elsewhere (see Elliot et al., 2017; Hulleman & Baron, in press; Karabenick & Urdan, 2014).

end academic performance. However, little is known about the boundary conditions of goal engagement treatment efficacy. Most relevant to the present study, it remains an open question whether goal engagement treatments can assist students with multiple academic risk factors, such as those with low HSGs and low optimism.

Theory and evidence suggest low HSG–low optimism students may be receptive to goal engagement treatments that target self-regulatory SSC processes (Hamm, Perry, Chipperfield, Stewart, & Heckhausen, 2015; Heckhausen et al., 1995, 2010; Poulin & Heckhausen, 2007). Heckhausen et al. (1995, 2010) postulate that SSC processes serve to maintain goal commitment for individuals who experience obstacles during goal pursuit. Students with co-occurring risk factors involving low HSGs and low optimism are likely to encounter significant obstacles to their academic goals (Carver & Scheier, 2014; Richardson et al., 2012). They are prone to failure (lack skills, work habits, content knowledge) and may not have the psychological resources needed to persist when setbacks occur (lack confidence, self-regulation, resilience).

Previous research shows that SSC processes are most adaptive under conditions that challenge motivational resources, such as those experienced by low HSG–low optimism students (Hamm et al., 2015; Poulin & Heckhausen, 2007). Thus, goal engagement treatments should assist these students by encouraging the use of deliberative SSC strategies that increase expectations of future success and goal commitment (Heckhausen et al., 1995, 2010). By engaging these volitional cognitive processes, goal engagement treatments may offset the typical negative expectancies and doubts harbored by low HSG–low optimist students (cf., Scheier & Carver, 1985, 2010). This should lead them to appraise the obstacles they face (deficits in skill, knowledge, and work habits) as more manageable and increase the likelihood that they persist.

Another previously unexamined boundary condition concerns the efficacy of goal engagement treatments when delivered via online learning environments. Noteworthy is that such technology-based learning environments are a double-edged sword, creating both new opportunities and obstacles for first-year college students in transition (Lee & Choi, 2011). They offer increased autonomy over the learning process (e.g., time and location that online lectures are viewed), and yet they also require students to take increased personal responsibility for their own learning and academic development during a difficult life course transition. For example, first-year students in online courses must master new and challenging course material within the context of an unfamiliar and impersonal learning environment, while at the same time being exposed to multiple sources of distraction (Moore & Kearsley, 2011). Widespread access to social media, video streaming services, and instant messaging are only a few technological advances that can distract students, erode goal-engagement, and undermine performance and persistence in online courses (Gaudreau, Miranda, & Gareau, 2014; Ravizza, Hambrick, & Fenn, 2014; Risko, Buchanan, Medimorec, & Kingstone, 2013). A major challenge under these conditions is to self-regulate and sustain motivation, especially for students with co-occurring risk factors involving low HSGs and low optimism. Although goal engagement treatments targeting self-regulatory SSC processes may be well-suited to assist low HSG–low optimism students under such motivationally demanding conditions, their efficacy has yet to be tested within the context of online learning environments.

Online administration of goal engagement treatments would be in keeping with current educational methods which commonly require students to access course information online as part of blended learning courses, distance courses, or Massive Open Online Courses. Hence, research is needed to examine whether goal engagement treatment efficacy is maintained when delivered via online learning environments that are less structured than controlled laboratory settings (cf. Hamm et al., 2016). Observing effects using such a technologically advanced online procedure that could be scaled up (mass delivered) would further support the ecological validity of goal engagement treatments (see Shadish, Cook, & Campbell, 2002).

Using a two-semester, pre-post, randomized treatment field design, we administered a goal engagement treatment targeting self-regulatory SSC processes to students who varied in HSGs (low, high) and optimism (low, high). Treatment protocols were administered via an online learning environment to test the efficacy of our scalable goal engagement treatment. We expected the goal engagement treatment (vs. no-treatment) to improve academic performance (class test grades) and persistence (sustained behavioral SPC, successful course completion) for students with co-occurring risk factors involving low HSGs and low optimism. Goal engagement treatment predictions were not specified for low HSG–high optimism students since high optimism could offset deficits arising from low HSGs. No goal engagement treatment effects were predicted for high HSG students because theory and evidence suggest that motivation treatments do not benefit students who are not academically at risk (Hamm et al., 2016; Perry, Chipperfield, Hladkyj, Pekrun, & Hamm, 2014; Perry & Hamm, 2017).

Method

Participants and Procedures

The online, pre-post, randomized treatment field study was based on a sample of students (n = 628) enrolled in a research-intensive university in Western Canada. The majority of students were 17- to 20-year-old (84%) females (63%) who were native English speakers (80%) in their first year of university (76%). Students were enrolled in an online introductory psychology course and participated in the study as part of a class assignment. Data were collected at seven time points over two academic semesters (September to April).

Time 1 (October) occurred in Semester 1 and required students to complete an online questionnaire using a secure website. Time 2 (October) immediately followed the Time 1 questionnaire and involved the secure website randomly assigning students to a goal engagement treatment condition or a no-treatment condition using automated software. Time 3 (November) consisted of a posttreatment class test that occurred in Semester 1. Times 4–6 occurred in Semester 2 and comprised a class test in February (Time 4), a second online questionnaire in March (Time 5), and a class test in April (Time 6). Course completion data were collected at Time 7 (April) from the course instructor at the end of Semester 2. Analyses were based on students who consented to their questionnaire and achievement data being used for research purposes.

Study Variables

High school grade (HSG; Semester 1). Self-reported HSG was assessed at Time 1 with a 10-point scale and used as a proxy for actual high school performance based on a strong relation between the two, r = .85 (see Sticca et al., 2017; see also Perry, Hladkyj et al., 2005; 1 = *50% or less*, 2 = *51-55%*, 3 = *56-60%*, 4 = *61-65%*, 5 = *66-70%*, 6 = *71-75%*, 7 = *76-80%*, 8 = *81-85%*, 9 = *86-90%*, 10 = *91-100%*; M = 7.75, SD = 1.67, range = 2–10). Previous research has demonstrated that this self-report measure of HSG is a reliable and substantial predictor of postsecondary achievement, including final course grades, r = .40–.54; and grade point averages, r = .51–.54 (e.g., Hamm et al., 2016; Hamm, Perry, Clifton, Chipperfield, & Boese, 2014; Perry, Hladkyj et al., 2001, 2005; Perry, Stupnisky, Hall, Chipperfield, & Weiner, 2010). A recent meta-analysis based on nearly two million students showed that HSGs were the strongest traditional correlate of college grade point averages (r = .41) and predicted college performance better than SAT or ACT scores (r = .37; Schneider & Preckel, 2017). See Table 1 for a summary of the main study variables.

Dispositional optimism (Semester 1). Scheier and Carver's (1985) Life Orientation Test assessed dispositional optimism at Time 1. The Life Orientation Test is a well-established measure of dispositional optimism that has been used in a wide variety of domains including academic, health, and athletic settings (Chen, Kee, & Tsai, 2008; Haynes et al., 2006; Nicholls, Polman, Levy, & Backhouse, 2008; Wrosch, Jobin, & Scheier, 2017). Participants rated their agreement with six items on a five-point scale (1 = *strongly disagree*, 5 = *strongly agree*). Three items were positively phrased (e.g., "In uncertain times, I usually expect the best"), and three items were negatively phrased (e.g., "If something can go wrong for me, it will"). Items were summed after negatively phrased items were reverse scored (M = 19.96, SD = 4.70; range = 6–30, α = .78). Optimism was assessed using the same scale in Semester 2 at Time 5 (M = 20.35, SD = 4.87; range = 6–30, α = .82, test–retest r = .75).

Previous research indicates the Life Orientation Test has suitable psychometric properties (αs = .74 to .79; 2-year test–retest reliability

Table 1
Summary of the Study Variables and Zero-Order Correlation Matrix

Variable	1	2	3	4	5	6	7	8	9	10	11
1. High school grade[a]	—										
2. Optimism[a]	.09*	—									
3. Behavioral SPC[a]	.18*	.28*	—								
4. Class Test 1[a]	.40*	.11*	.25*	—							
5. Class Test 2[a]	.39*	.09*	.26*	.72*	—						
6. Class Test 3[b]	.39*	.02	.21*	.68*	.65*	—					
7. Class Test 4[b]	.36*	.07	.20*	.65*	.67*	.69*	—				
8. Optimism[b]	.08	.75*	.25*	.22*	.16*	.14*	.15*	—			
9. Behavioral SPC[b]	.16*	.24*	.69*	.28*	.28*	.24*	.28*	.30*	—		
10. Cumulative performance[b]	.43*	.07	.26*	.75*	.89*	.88*	.88*	.17*	.30*	—	
11. Course completion[b]	.21*	.04	.10*	.50*	.49*	.33*	.46*	.04	.10*	.42*	—
M	7.75	19.96	3.98	63.35	65.94	65.06	71.30	20.35	3.94	68.59	.79
SD	1.67	4.70	.77	16.39	17.64	14.65	14.18	4.87	.77	13.24	.40

Note. SPC = selective primary control.
[a] Semester 1 measure. [b] Semester 2 measure.
* $p \leq .05$ (two-tailed tests).

*r*s = .70 to .75; Achat, Kawachi, Spiro, DeMolles, & Sparrow, 2000; Ruthig et al., 2004; Wrosch et al., 2017). Past meta-analyses and systematic reviews of meta-analyses based on nearly 2 million students have established the test is a reliable predictor of college grade point averages (r = .11; Richardson et al., 2012; Schneider & Preckel, 2017).

Goal engagement treatment (Semester 1). The goal engagement treatment was administered online to individual students at Time 2 using the secure website and immediately followed the Time 1 questionnaire. Treatment implementation fidelity was achieved using a standardized delivery method: The goal engagement treatment consisted of a prerecorded video presentation described below, and students were randomly assigned to the goal engagement treatment condition or the no-treatment condition using an automated software protocol that ensured uniform implementation (see Shadish et al., 2002).

Treatment administration occurred during 1-hr sessions that consisted of three stages. First, the activation stage had students reflect on previous academic successes and failures to heighten the relevance of the treatment content (see Perry et al., 2014, 2017). Activation was accomplished by having participants rate their perceived success and grade satisfaction in the introductory course, as well as by administering the treatment only after students received performance feedback on their first class test (see Hamm et al., 2016).

Second, the induction stage had participants view a narrated video presentation that focused on how students who employ self-regulatory SSC strategies can improve their performance. Based on Heckhausen et al.'s (1995, 2010) theory and past research (Hamm et al., 2013, 2015), the narrated presentation indicated that (a) students who set academic goals tend to achieve higher grades, (b) maintaining motivation for academic goals is difficult, and (c) students who actively use self-regulatory SSC strategies to sustain their motivational commitment are more likely to achieve their academic goals. SSC strategies were introduced using the acronym *APP* to provide students with a simple mnemonic to facilitate retention of the treatment message. APP strategies presented in the treatment involved *anticipation* (e.g., reminding oneself how good it will feel to succeed), *prioritization* (e.g., reminding oneself how important a university education is to one's future career), and *persistence* (e.g., reminding oneself of others who have succeeded despite obstacles and initial setbacks).

Third, the *consolidation* stage used a writing activity to facilitate deep processing of the treatment content based on previous research (Hamm et al., 2016; see also Haynes, Perry, Stupnisky, & Daniels, 2009 and Perry et al., 2014). Participants were instructed to (a) set an academic goal, (b) write about the positive emotions they anticipated experiencing after achieving the goal (anticipation), (c) write about why their academic goals were a priority (prioritization), and (d) write about a personal model of persistence (persistence). Students in the no-treatment control sessions simply completed the Time 1 questionnaire. The treatment variable was dummy-coded (0 = *no-treatment* [*n* = 383], 1 = *goal engagement treatment* [*n* = 245]).

Several precautions were taken to ensure the ecological validity of the treatment protocols based on recommendations by Tunnell (1977) and Lazowski and Hulleman (2016; see also Hulleman, Barron, Kosovich, & Lazowski, 2016; Shadish et al., 2002). According to Tunnell (1977) and Lazowski and Hulleman (2016), ecological validity of experimental field procedures must meet three criteria based on naturalness:

> (1) *Natural treatments* are naturally occurring events to which the participant is exposed (e.g., pedagogical practices, curriculum), (2) *natural settings* are those that are not perceived to be established for the purposes of research (e.g., almost any setting outside the laboratory; see Shadish et al., 2002), and (3) *natural behavior* occurs on its own without experimental intervention (e.g., statewide mandated standardized tests). (Lazowski & Hulleman, 2016, p. 5)

On the basis of this framework, our study conforms to all criteria. Regarding natural treatments, goal engagement treatment content was designed to achieve ecological validity by incorporating material related to class lectures and textbook readings in the introductory psychology course. Treatment protocols were also embedded in the course curriculum as an assignment, and the online questionnaire and video presentation was consistent with the course's online lecture format. Regarding natural settings, treatment protocols were administered via the same online learning environment that students used to access their other course materials. This enabled students to access the online treatment protocols in a natural setting (on campus or at home) rather than within an artificial laboratory environment. Regarding natural behavior, a primary outcome measure (class test grades) was developed and administered by the course instructor and therefore captured a naturally occurring behavior within the educational context. In contrast to alternative measures such as researcher-created achievement tests, course grades reflect an authentic and consequential performance outcome that predicts future educational attainment (r = .48) and occupational status (r = .33; see Richardson et al., 2012; Strenze, 2007).

Treatment comprehension quiz. Prior to the goal engagement treatment and no-treatment sessions, students were informed that they would complete an eight-item quiz based on the video and/or pretreatment questionnaire. The goal engagement treatment quiz assessed content in the goal engagement treatment video and questionnaire; the no-treatment quiz assessed content only in the questionnaire. Each quiz was intended to focus attention on the goal engagement treatment video and/or questionnaire in the presence of distractions common to online learning conditions in which students completed the course assignment. Students in the goal engagement treatment and no-treatment conditions achieved high scores on their respective quizzes (respective *M*s = 89%, 91%), indicating that they attended equally well to the goal engagement treatment video and/or questionnaire.

Class test grades (Semesters 1 and 2). Consenting students' academic performance was measured using their grades (percentages) on three posttreatment class tests in the two-semester course. Class Test 2 (November; M = 65.94, SD = 17.64; range = 14.70–100.00) occurred in Semester 1. Class Test 3 (February; M = 65.06, SD = 14.65; range = 8.00–97.50) and Class Test 4 (April; M = 71.30, SD = 14.18; range = 12.50–97.50) occurred in Semester 2. Initial performance on a pretreatment (October, Time 1) Class Test 1 was also assessed (M = 63.35, SD = 16.39; range = 20.00–100.00). Class test grades were collected from the course instructor at the end of the second semester.

Cumulative performance (Semesters 1 and 2). Grades (percentages) on Class Tests 2-4 were averaged to create a cumulative measure of posttreatment academic performance for a supplemental analysis (M = 68.59, SD = 13.24; range = 26.83–95.83).

Behavioral SPC (Semester 2). Four domain-specific items from the Academic Specific Control Strategies scale assessed a theory-derived measure of behavioral SPC at Time 5 (e.g., "If it gets more difficult to get the education that I want, I will try harder; Hamm et al., 2013). Participants rated their agreement with the items using a five-point scale (1 = *strongly* *disagree*, 5 = *strongly agree*; $M = 3.94$, $SD = 0.76$; range = 1.00–5.00, α = .85). Behavioral SPC was assessed using the same scale in Semester 1 at Time 1 ($M = 3.98$, $SD = 0.77$; range = 1.50–5.00, α = .85, test–retest $r = .69$). Confirmatory factor analyses conducted by Hamm et al. (2013) indicate that the behavioral SPC items form a satisfactory psychometric scale that conforms to its theoretical underpinnings. Research assessing the 5-month test–retest reliability of this measure has shown acceptable stability over time (r range = .57–.63; Hamm et al., 2015, 2016).

Successful course completion (Semester 2). Time 7 data on course withdrawals and course failure were used to create a composite measure of successful course completion. The measure distinguished students who withdrew from or failed (final grade <50%) the two-semester course from those who passed the course (0 = *withdrew from or failed course* [21%], 1 = *passed course* [79%]). This measure reflects functional course completion since students who withdrew from or failed the two-semester course did not receive the 6 credit hours (equal to two one-semester courses) for course completion (see also Paunesku et al., 2015).

Results

Treatment × High School Grade (HSG) × Optimism regression models were used to test the hypotheses. Simple slope regression analyses probed interactions to assess goal engagement treatment effects at low (−1 *SD*) and high (+1 *SD*) levels of HSG and optimism (Cohen, Cohen, West, & Aiken, 2003; Hayes, 2013). A priori (one-tailed) tests assessed the directional prediction that the goal engagement treatment (vs. no-treatment) would improve academic performance and persistence for low HSG–low optimism students with co-occurring risk factors. All regression analyses were calculated with Mplus 7 using maximum likelihood robust estimation, which accommodated both the continuous and binary outcome variables and permitted the calculation of standard errors for predicted outcome values (Muthén & Muthén, 1998–2015).[2]

Standardized regression weights are reported for all effects with the exception of the treatment effects. Because the treatment variable is dichotomous, it was left in its original metric to enable valid interpretation (0 = *no-treatment*, 1 = *goal engagement treatment*; Hayes, 2013). Hence, goal engagement treatment effects are partially standardized and reflect the mean difference between the goal engagement treatment and no-treatment conditions on the dependent measures reported in standard deviation units (e.g., the standard deviation difference between the treatment conditions on Class Test 2). Note that a partially standardized beta weight is conceptually analogous to Cohen's *d*. Thus, a partially standardized treatment effect of $\beta = .45$ on Class Test 2 indicates that low HSG-low optimism students who received the goal engagement treatment outperformed their no-treatment peers by 0.45 of a standard deviation.

Preliminary Analyses

Random assignment to treatment conditions. In keeping with randomized treatment design principles (Shadish et al., 2002), students were randomly assigned to experimental conditions (goal engagement treatment, no-treatment) using automated software. Results of independent sample *t* tests showed the goal engagement treatment and no-treatment conditions did not differ with respect to pretreatment demographic (gender, age, language, year in university), psychosocial (optimism, behavioral SPC), or performance (HSG, pretreatment class test grades) measures (all $ps > .05$).

Zero-order correlations. Correlation coefficients provided a description of the unadjusted relationships between the study variables (see Table 1). HSGs had a strong, positive, and consistent association with Semester 1 (rs = .40, .39) and Semester 2 (rs = .39, .36) class test grades. Semester 1 optimism correlated positively with Semester 1 class test grades (rs = .11, .09), and Semester 2 optimism correlated positively with Semester 2 class test grades (rs = .14, .15). Semester 1 and 2 optimism was also positively associated with Se-

[2] We tested our hypotheses using the analytic approach recommended by Aiken, West, and Reno (1991); Cohen et al. (2003); and Hayes (2013) to assess conditional effects (simple-simple slopes) within a regression analysis based on the full sample and the entire variance in the design. Specifically, we tested conditional effects (simple-simple slopes) of the goal engagement treatment at low (–1 *SD*) and high (+1 *SD*) levels of continuous HSG and optimism within Treatment × HSG × Optimism regression models.

mester 1 (respective *r*s = .29, .25) and Semester 2 (respective *r*s = .24, .30) behavioral SPC. Semester 1 and 2 class test grades had strong and positive associations with one another (*r* range = .65–.72). Cumulative performance was positively correlated with HSGs (*r* = .43), Semester 1 and 2 behavioral SPC (*r*s = .26, .30), Semester 2 optimism (*r* = .17), and Semester 1 and 2 class test grades (*r* range = .75–.89). Successful course completion was positively associated with HSGs (*r* = .21), Semester 1 and 2 behavioral SPC (*r*s = .10, .10), Semester 1 and 2 class test grades (*r* range = .33–.50), and cumulative performance (*r* = .42).

Main Analyses

Treatment × HSG × Optimism regression models assessed whether the goal engagement treatment had effects on two-semester academic performance and persistence outcomes consistent with theory (Heckhausen et al., 2010). Results for the performance outcomes (class test grades) confirmed the three-way interaction for posttreatment Class Test 2 (β = .08, *Z* = 2.27, *n* = 617, *p* = .023), Class Test 3 (β = .12, *Z* = 3.13, *n* = 518, *p* = .002), and Class Test 4 (β = .10, *Z* = 2.53, *n* = 511, *p* = .011). See Table 2 for a summary of the regression coefficients and confidence intervals.

Interactions were probed by testing simple-simple treatment effects (slopes) at low (−1 *SD*) and high (+1 *SD*) levels of (continuous) HSG and optimism using Mplus 7 (Cohen et al., 2003; Hayes, 2013; Muthén & Muthén, 1998–2015). Goal engagement treatment effects were thus tested at four combinations of the moderators: low HSG–low optimism, low HSG–high optimism, high HSG–low optimism, and high HSG–high optimism.

As expected, simple–simple slope regression analyses showed that the goal engagement treatment (vs. no-treatment) improved class test grades for only low HSG–low optimism students (see Figure 1). Those who received the goal engagement treatment outperformed their no-treatment peers by 8% on Class Test 2 (partially standardized β = .45, *Z* = 2.99, *n* = 617, *p* = .002), 7% on Class Test 3 (partially standardized β = .45, *Z* = 3.01, *n* = 518, *p* = .002), and 7% on year-end Class Test 4 (partially standardized β = .46, *Z* = 2.75, *n* = 511, *p* = .003). Partially standardized β effect sizes (.45, .45., .46) indicated that low HSG–low optimism students in the goal engagement treat-

Table 2
Regression Coefficients for Academic Performance Outcomes (Class Test Grades)

Predictor variable	Class Test 2 β	Class Test 2 95% CIs	Class Test 3 β	Class Test 3 95% CIs	Class Test 4 β	Class Test 4 95% CIs
Goal engagement treatment	.15*	[.002, .296]	.04	[−.112, .204]	.04	[−.120, .206]
High school grade (HSG)	.39*	[.318, .457]	.41*	[.325, .484]	.36*	[.283, .444]
Optimism (OPT)	.06	[−.012, .126]	.00	[−.073, .076]	.05	[−.030, .127]
Treatment × HSG	−.03	[−.097, .046]	−.03	[−.110, .048]	−.06	[−.137, .026]
Treatment × OPT	−.04	[−.107, .029]	−.05	[−.121, .032]	−.04	[−.123, .034]
HSG × OPT	.00	[−.076, .067]	−.02	[−.100, .054]	−.01	[−.085, .073]
Treatment × HSG × OPT[a]	.08*	[.011, .147]	.12*	[.044, .192]	.10*	[.023, .178]
Treatment at low HSG–low OPT[b]	.45*	[.204, .702]	.45*	[.205, .700]	.46*	[.186, .739]
Treatment at low HSG–high OPT	−.05	[−.375, .277]	−.24	[−.567, .096]	−.15	[−.521, .227]
Treatment at high HSG–low OPT	.00	[−.285, .289]	−.18	[−.525, .158]	−.20	[−.503, .107]
Treatment at high HSG–high OPT	.19	[−.063, .443]	.14	[−.159, .448]	.05	[−.247, .356]
R^2		.17		.17		.15

Note. HSG = high school grade; OPT = optimism.
[a] Simple goal engagement treatment effects (slopes) from the Treatment × HSG × OPT interaction are shown for each of the four combinations of HSG (low, high) and OPT (low, high). All predictors are *z* standardized with the exception of goal engagement treatment, which has been left in its original metric to facilitate interpretation (0 = *no-treatment*, 1 = *goal engagement treatment*). [b] Confidence intervals (CI) are 90% for low HSG–low OPT combination that reflects multiple academic risk factors (one-tailed tests based on a priori directional predictions) and 95% for other combinations that reflect one or no academic risk factors (two-tailed tests due to no specified predictions).
* $p \leq .05$.

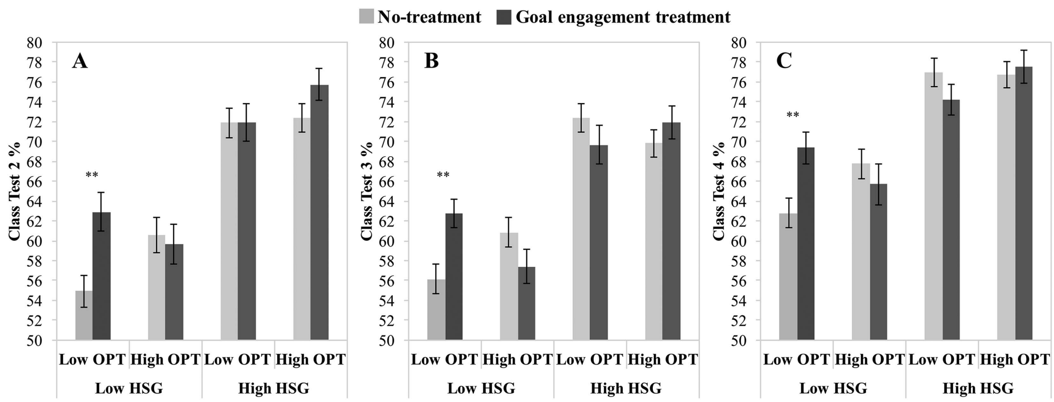

Figure 1. The Treatment × High School Grade (HSG) × Optimism (OPT) interaction on Class Test 2 (Panel A), Class Test 3 (Panel B), and Class Test 4 grades (Panel C). Simple effects (slopes) of goal engagement treatment (vs. no-treatment) are presented at low (−1 *SD*) and high (+1 *SD*) levels of high school grades (HSG) and optimism (OPT). Error bars represent ±1 *SE*. ** $p \leq .01$.

ment condition had Class Test 2-4 grades that were nearly half a standard deviation higher than their peers in the no-treatment condition. Effects were consistent when autoregressive effects of pretreatment Class Test 1 grades were controlled. No treatment effects were observed for students with the other three combinations of HSG and optimism (*p* range = .142–.989).[3,4]

Results for the persistence outcomes confirmed the three-way interaction for course completion ($OR = 1.22$, $Z = 2.03$, $n = 617$, $p = .042$) and revealed a marginal interaction for behavioral SPC ($\beta = .08$, $Z = 1.81$, $n = 445$, $p = .071$). See Table 3 for a summary of the regression coefficients and confidence intervals. Consistent with the hypotheses, simple-simple slope regression analyses showed the goal engagement treatment (vs. no-treatment) increased the odds of course completion for only low HSG–low optimism students ($OR = 1.89$, $Z = 1.80$, $n = 617$, $p = .037$). The odds ratio of 1.89 indicates that odds of course completion were 89% higher for low HSG–low optimism students who received the goal engagement treatment versus no-treatment (see Figure 2). No treatment effects were observed for students with the other three combinations of HSG and optimism (*p* range = .071–.844).

Simple–simple slope regression analyses also showed that low HSG–low optimism students in the goal engagement treatment condition reported higher 5-month behavioral SPC than their peers in the no-treatment condition (partially standardized $\beta = .70$, $Z = 4.38$, $n = 445$, $p < .001$). Effects were consistent when pretreatment behavioral SPC was controlled. No treatment effects were observed for students with the other three combinations of HSG and

[3] Treatment effects were consistent when accounting for autoregressive effects of pre-treatment Class Test 1 grades: For only low HSG–low optimism students, the goal engagement treatment (vs. no-treatment) increased Class Test 2 grades [partially standardized $\beta = .30$, $p = .008$], Class Test 3 grades [partially standardized $\beta = .22$, $p = .036$], and Class Test 4 grades [partially standardized $\beta = .24$, $p = .052$]. The goal engagement treatment (vs. no-treatment) also increased cumulative posttreatment performance for only low HSG–low optimism students when pre-treatment Class Test 1 grades were controlled [partially standardized $\beta = .35$, $p = .004$].

[4] Treatment effects were consistent in sensitivity tests that restricted the sample to only first-year college students. For only low HSG–low optimism students, the goal engagement treatment (vs. no-treatment) increased Class Test 2 grades [partially standardized $\beta = .37$, $p = .030$], Class Test 3 grades [partially standardized $\beta = .52$, $p = .002$], and Class Test 4 grades [partially standardized $\beta = .45$, $p = .020$]. The goal engagement treatment (vs. no-treatment) also increased cumulative posttreatment performance [partially standardized $\beta = .60$, $p = .002$], behavioral SPC [partially standardized $\beta = .54$, $p = .004$], and marginally increased the odds of course completion [$OR = 1.80$, $p = .087$] for only low HSG–low optimism students.

Table 3
Regression Coefficients for Academic Persistence Outcomes

Predictor variable	Course completion		Behavioral SPC	
	OR^c	95% CIs	β	95% CIs
Goal engagement treatment	1.34	[.862, 2.067]	.12	[−.062, .299]
High school grade (HSG)	1.66*	[1.377, 2.006]	.15*	[.066, .239]
Optimism (OPT)	1.02	[.838, 1.245]	.25*	[.162, .334]
Treatment × HSG	1.02	[.841, 1.235]	−.13*	[−.213, −.046]
Treatment × OPT	1.01	[.827, 1.229]	−.07	[−.157, .016]
HSG × OPT	0.90	[.747, 1.092]	−.06	[−.152, .039]
Treatment × HSG × OPT[a]	1.22*	[1.007, 1.473]	.08†	[−.008, .172]
Treatment at low HSG–low OPT[b]	1.89*	[1.056, 3.394]	.74*	[.440, .969]
Treatment at low HSG–high OPT	0.87	[.387, 1.967]	.07	[−.310, .457]
Treatment at high HSG–low OPT	0.91	[.363, 2.291]	−.19	[−.599, .228]
Treatment at high HSG–high OPT	2.12	[.939, 4.775]	−.12	[−.436, .199]
R^2		.09		.11

Note. HSG = high school grade; OPT = optimism; SPC = selective primary control.
[a] Simple goal engagement treatment effects (slopes) from the Treatment × HSG × OPT interaction are shown for each of the four combinations of HSG (low, high) and OPT (low, high). All predictors are *z* standardized with the exception of goal engagement treatment, which has been left in its original metric to facilitate interpretation (0 = *no-treatment*, 1 = *goal engagement treatment*). [b] Confidence intervals (CI) are 90% for low HSG–low OPT combination that reflects multiple academic risk factors (one-tailed tests based on a priori directional predictions) and 95% for other combinations that reflect one or no academic risk factors (two-tailed tests due to no specified predictions). [c] Odds ratios are presented for the dichotomous course completion outcome (0 = *withdrew from or failed course*, 1 = *passed course*).
† $p \leq .10$. * $p \leq .05$.

optimism (p range = .380–.706; see Table 4 for predicted values).[5]

Supplemental Analysis

A supplemental Treatment × HSG × Optimism regression model assessed goal engagement treatment effects for *cumulative* posttreatment performance on Class Tests 2-4 using Mplus 7. The predicted three-way interaction was confirmed ($\beta = .12$, $Z = 3.34$, $n = 509$, $p = .001$) and probed with tests of simple-simple treatment effects (slopes) at low (−1 *SD*) and high (+1 *SD*) levels of HSG and optimism.

As expected, simple-simple slope analyses showed that cumulative posttreatment performance was 8% higher (67.01% vs. 58.93%) for low HSG–low optimism students who received the goal engagement treatment relative to their no-treatment peers (partially standardized $\beta = .61$, $Z = 3.93$, $n = 509$, $p < .001$). Effects were consistent when autoregressive effects of pretreatment Class Test 1 grades were controlled. No treatment effects were observed for those with the remaining three combinations of HSG and optimism (p range = .278-.459).

Discussion

The present study shows that motivation treatments to enhance goal engagement can improve performance and persistence for college students with co-occurring risk factors. Findings advance the literature on motivation treatment interventions amenable to mass administration via online technologies (see Karabenick & Urdan, 2014 and Elliot, Dweck, & Yeager, 2017). Increasing evidence suggests online motivation treatments can improve academic outcomes for college stu-

[5] Treatment effects were consistent when accounting for autoregressive effects of pre-treatment Semester 1 behavioral SPC: For only low HSG–low optimism students, the goal engagement treatment (vs. no-treatment) increased Semester 2 behavioral SPC (partially standardized $\beta = .36$, $p = .004$).

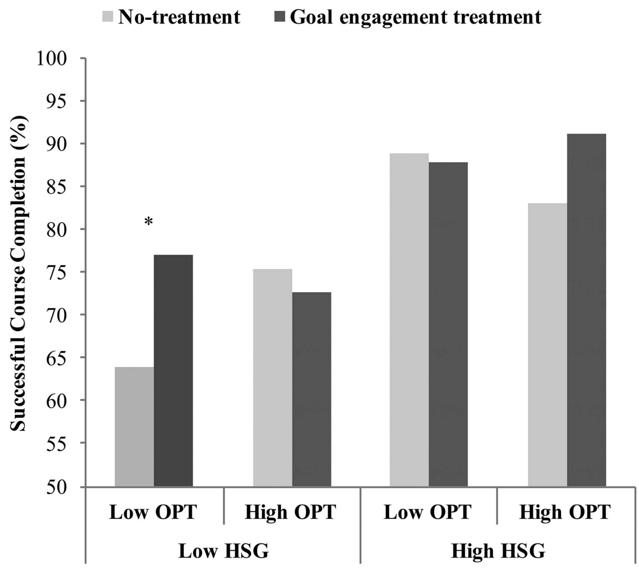

Figure 2. The Treatment × High School Grade (HSG) × Optimism (OPT) interaction on two-semester course completion. Simple effects (slopes) of goal engagement treatment (vs. no-treatment) are presented at low (−1 *SD*) and high (+1 *SD*) levels of HSG and OPT based on the logistic regression analyses. * $p \leq .05$.

dents, but few studies have examined the moderating role of multiple risk factors (e.g., Hamm, Perry, Chipperfield, Murayama, & Weiner, 2017; Parker et al., 2016, 2018). Our study suggests (a) it is important to consider the broader ecological reality experienced by students with co-occurring risk factors and (b) that online goal engagement treatments can assist such failure-prone individuals who have low HSGs and low optimism.

Results contribute to a more nuanced understanding of boundary conditions that modulate goal engagement treatment efficacy. Past research by Hamm et al. (2016) found a goal engagement treatment improved performance for students with a single risk factor (low HSG–high perceived control), but not for those with co-occurring risk factors (low HSG–low perceived control). These findings may be due to the nature and relative influence of such risk factors in postsecondary achievement settings. Comprehensive meta-analyses by Robbins et al. (2004) and Richardson et al. (2012) showed HSGs (*r*s = .40 to .41) and perceived control (*r*s = .31 to .59) were the strongest traditional and psychosocial correlates of college performance. HSGs and perceived control thus represent two of the most influential academic risk factors in postsecondary achievement settings. This implies students with a low HSG–low perceived control risk profile likely suffer considerable motivation deficits that a one-time goal engagement treatment may be unable to remedy (see Perry & Penner, 1990; see also Hamm et al., 2016).

Although past studies have consistently shown that optimism also predicts performance in postsecondary achievement settings, its relationship to college grade point average is not as pronounced (*r* = .11; Richardson et al., 2012; Schneider & Preckel, 2017). This does not imply that low HSG–low optimism students are not at risk of academic failure. In fact, our results show that, without treatment, these students had the lowest grades on multiple class tests (Class Test 2-4 range = 55% to 63%), reported the lowest 5-month behavioral SPC (3.39/5.00), and were least likely to successfully complete the two-semester course (64% completed). Collectively, these studies suggest that a low HSG–low optimism risk profile is maladaptive, but it may be less toxic than a low HSG–low perceived control

Table 4
Predicted Values for Goal Engagement Treatment Effects at Low and High Combinations of High School Grade and Optimism

Outcome measure	Low HSG (−1 *SD*)				High HSG (+1 *SD*)			
	Low OPT (−1 *SD*)		High OPT (+1 *SD*)		Low OPT (−1 *SD*)		High OPT (+1 *SD*)	
	No-treatment	GE treatment	No-treatment	GE treatment	No-treatment	GE treatment	No-treatment	GE treatment
Test 2	54.92 (1.57)[a]	62.90 (1.96)[a]	60.55 (1.80)	59.68 (2.01)	71.86 (1.50)	71.89 (1.91)	72.39 (1.44)	75.74 (1.63)
Test 3	56.13 (1.48)[a]	62.75 (1.45)[a]	60.86 (1.50)	57.40 (1.71)	72.36 (1.47)	69.67 (1.90)	69.80 (1.39)	71.91 (1.64)
Test 4	62.78 (1.48)[a]	69.34 (1.66)[a]	67.76 (1.47)	65.67 (2.03)	76.97 (1.42)	74.159 (1.54)	76.75 (1.32)	77.52 (1.61)
Behavioral SPC	3.39 (0.08)[a]	3.93 (0.08)[a]	4.05 (0.08)	4.10 (0.10)	3.98 (0.11)	3.83 (0.10)	4.24 (0.08)	4.16 (0.09)
Cumulative performance	58.93 (1.41)[a]	67.01 (1.31)[a]	64.32 (1.41)	62.71 (1.41)	74.94 (1.28)	72.63 (1.57)	73.88 (1.27)	75.68 (1.39)
Course completion (%)	63.86 (4.76)[a]	76.98 (4.81)[a]	75.33 (3.76)	72.69 (6.53)	88.82 (2.88)	87.87 (3.69)	83.00 (3.08)	91.17 (2.55)

Note. Standard errors are shown in parentheses. HSG = high school grade; OPT = optimism; GE treatment = goal engagement treatment; SPC = selective primary control.
[a] Simple slope contrasts for goal engagement treatment (vs. no-treatment) are significant at $p < .05$ for the low HSG-low optimism combination that reflects multiple risk factors (one-tailed tests based on a priori directional predictions). Simple slope contrasts for goal engagement treatment (vs. no-treatment) are not significant (all $ps > .05$) for other combinations of HSG and optimism that reflect one or no risk factors (two-tailed tests due to no specified predictions).

risk profile and more amenable to remediation via goal engagement treatments.[6]

Study findings also provide further support for the external and ecological validity of goal engagement treatments (cf., Shadish et al., 2002; Tunnell, 1977). They show that such treatments are scalable and can assist failure-prone college students when delivered in unstructured online learning environments. Results extend previous research by Hamm et al. (2016) that found a goal engagement treatment administered in a controlled laboratory setting produced two-semester performance gains. Noteworthy is that treatment effect sizes on two-semester performance in the present study (partially standardized βs = .45 to .46) were relatively similar to those observed in Hamm et al.'s (2016) laboratory-based study (partially standardized β = .62). This suggests that online administration did not significantly impair treatment efficacy.

Goal Engagement Treatment Efficacy for College Students With Multiple Risk Factors

Treatment effects for low HSG–low optimism students were moderate in size (see Cohen, 1988) and consistent across multiple post-treatment class tests that spanned two semesters. As depicted in Figure 1, effect sizes are ecologically relevant and translate into full letter grade differences based on the actual grade distribution used in the course. For instance, low HSG–low optimism students who received the goal engagement treatment outperformed their no-treatment peers by 8% (C vs. D) on Class Test 2 that occurred 1 week post-treatment. This performance advantage was maintained into Semester 2, which is notable given that students had an extended (3-week) holiday after Semester 1.

Such protracted absences from college involve breaks from academic routines that may

[6] In contrast to low HSG–low optimism students in the no-treatment condition, those who received the goal engagement treatment had class test grades (Class Test 2-4 range = 63% to 69%) and course completion rates (77% completed) that were notably better and similar to their peers with only a single risk factor: those with low HSGs and high optimism (see Figures 1 and 2).

be accompanied by concomitant shifts in goal prioritization (e.g., increased emphasis on social, work goals; Prescott & Simpson, 2004). This has the potential to precipitate academic goal disengagement, particularly for struggling students. Returning for Semester 2 requires academic goal reengagement which is likely to prove a significant challenge for low HSG–low optimism students who have difficulty self-regulating their academic behaviors (Carver & Scheier, 2014; Geers et al., 2009). These contextual dynamics could weaken treatment effects if the goal engagement treatment produced an initial motivation boost that dissipated over time. This was not the case, as the treatment conferred a similar performance advantage in Semester 2: Low HSG–low optimism students in the treatment condition achieved grades that were a letter grade higher (C+ vs. C) than their peers in the no-treatment condition on both of the Semester 2 class tests (Class Tests 3 and 4).

Treatment effects on the two-semester persistence outcomes were moderate to large in size (see Cohen, 1988) and of similar ecological relevance. A partially standardized β effect size of .70 indicates that low HSG–low optimism students who received the goal engagement treatment self-reported behavioral SPC that was nearly three quarters of a standard deviation higher than their no-treatment peers. Results for self-reported persistence were corroborated by those based on an objective persistence measure (successful course completion). Odds of successful course completion were 89% higher for low HSG–low optimism students who received the goal engagement treatment versus no-treatment. Results replicate and extend previous research that had shown goal engagement treatments increase self-reported persistence, but had yet to examine treatment effects on objective persistence indicators (Hamm et al., 2016).

These findings have practical implications for failure-prone students who aspire to earn college degrees. Low HSG–low optimism students who received the goal engagement treatment were significantly less likely to withdraw from or fail the two-semester course (i.e., a large majority successfully completed the course). As a result, they saved time and money in their degree programs since they did not have to retake the course the following academic year. Completing the course also culminated in low HSG–low optimism students earning an additional 6 credit hours (equal to two one-semester courses) toward their degree requirements. This represents a small but appreciable portion (roughly 7%) of the course work required for a bachelor's degree at the present institution. Higher course completion rates and improved class test grades for low HSG–low optimism students who received treatment is likely to have positive downstream effects on future educational outcomes. Passing the course with better grades not only increases the odds of graduation (Johnson, 2008), it may also facilitate admittance to more competitive professional or graduate programs (see Perry, Hladkyj et al., 2001, 2005).

Strengths, Limitations, and Future Directions

One strength of this study was its reliance on the strong theoretical framework afforded by Heckhausen et al.'s (1995, 2001, 2010) motivational theory of life-span development. The fundamental principles of Heckhausen's theory are clear, specific, testable, and supported by over 20 years of empirical evidence. Another strength was the use of objective and ecologically valid achievement outcomes as dependent measures: students' performance on three post-treatment class tests in a two-semester course (see Lazowski & Hulleman, 2016; Richardson et al., 2012; Shadish et al., 2002; Tunnell, 1977). Such measures represent authentic and consequential performance outcomes that predict future educational attainment (r = .48) and occupational status (r = .33; see Richardson et al., 2012; Strenze, 2007). We also employed a pre-post, randomized treatment design and accounted for autoregressive effects. These procedures make causal inferences more viable than studies that fail to manipulate the independent variables or adjust for preexisting differences in the dependent measures (Shadish et al., 2002).

Administration of treatment protocols via an online learning environment strengthened the ecological validity of our study (see Lazowski & Hulleman, 2016; Tunnell, 1977). Yet it was also a limitation given that students may have experienced distractions in the online learning conditions in which they completed the protocols. However, performance on quizzes that assessed treatment comprehension showed that students in both the goal engagement treatment

(89%) and no-treatment (91%) conditions attended well to the treatment video and/or questionnaire content.

A second limitation concerns our self-reported measure of HSG, which may not correspond perfectly to actual high school performance. However, previous research attests to the validity of this measure by showing it shares a strong association with actual HSGs (r = .84; Perry, Hladkyj et al., 2005; see also Sticca et al., 2017). Further, our results (HSG-performance r range = .36–.40) are in line with past studies indicating that this self-report measure of HSG is a reliable and substantial predictor of postsecondary performance (e.g., Hamm et al., 2014; Perry, Hladkyj et al., 2001, 2005; Perry et al., 2010). For example, Perry, Hladkyj et al. (2005) found that the present self-report measure of HSG was strongly correlated with college students' (objective) cumulative GPAs in Year 1 (r = .52), Year 2 (r = .52), and Year 3 (r = .53). HSG–performance correlations observed in our study are also consistent with two recent meta-analyses that reported correlations between HSG and college GPA that were of similar magnitude (rs = .40 to .41; Richardson et al., 2012; Schneider & Preckel, 2017).

The present study points to several avenues for future research. For instance, few studies have examined the psychological mechanisms that account for goal engagement treatment effects on academic performance and persistence (cf., Hamm et al., 2016). Research is needed to test the theoretical proposition that goal engagement treatments may facilitate goal attainment as a function of their capacity to increase expectations of future success and strengthen goal commitment when faced with obstacles (Heckhausen et al., 2010; Schulz & Heckhausen, 1996).

Another productive area for future research may be the personalization of treatment content (see Perry & Hamm, 2017). New technologies could be leveraged to individualize goal engagement treatments and increase cognitive engagement. One possibility entails incorporating personalized information that shows goal engagement treatment recipients their pretreatment APP profiles (use of self-regulatory strategies comprising anticipation, prioritization, and persistence) as an activation or consolidation procedure. Goal engagement treatments that involve such active engagement protocols may facilitate deeper processing of content tailored to each recipient and thereby boost treatment efficacy.

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