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A motivation-enhancing treatment to sustain goal engagement during life course transitions

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Abstract Although theory-driven control striving treatments may sustain motivation for individuals navigating life course transitions, their efficacy during these challenging junctures remains unexamined. In a pre-post randomized field study ($n = 316$), a novel control striving treatment based on Heckhausen et al.'s (Psychol Rev 117:32–60, 2010) motivational theory of life-span development was administered to young adults making the landmark transition to university. For students who faced obstacles to goal attainment, the motivation-enhancing selective secondary control (SSC) striving treatment (vs. no-treatment) increased performance by 8 % in a two-semester course (74.85 % vs. 66.68 %). Consistent with theory, the SSC treatment-performance linkage was mediated by selective secondary and selective primary control in a hypothesized causal sequence. Findings advance the literature by showing control striving treatments can improve performance for some young adults in transition by promoting adaptive changes in theoretically-derived psychological process variables.

Keywords Motivation-enhancing treatment · Goal engagement · Primary and secondary control · Life course transitions · Perceived control

Introduction

Life course transitions occur in semi-structured intervals throughout the life-span and provide optimal time windows of opportunity to pursue consequential developmental goals (e.g., first job, marriage; Heckhausen 1997; Heckhausen et al. 2010). However, these junctures are also imbued with substantial uncertainty and require individuals to pursue transition-relevant and age-sensitive goals while adapting to challenges associated with entering a new environment (e.g., work place; Haase et al. 2012; Perry 2003). For instance, young adults navigating the landmark shift from high school to university have ample opportunity to pursue a critical developmental goal (i.e., a university education). But their success depends on persistent goal engagement in the face of novel challenges that include frequent failures, unstable social networks, new living arrangements, and critical career choices (Perry 1991; Perry et al. 2001).

Recent evidence points to the challenges of sustaining motivation and goal engagement under such conditions. A survey of over 28,000 university students revealed that, within the previous year, 45 % felt things were hopeless, 50 % experienced immense anxiety, and 85 % were overwhelmed by their responsibilities (American College Health Association [ACHA] 2012). National estimates by the U.S. Department of Education suggest the challenges inherent in this transition have negative consequences for goal attainment: Nearly 30 % of freshman students enrolled in 4-year programs withdraw from their institutions within their first year and only 57 % graduate after 6 years (Snyder and Dillow 2013).

Theory-driven treatments to increase control striving may be effective in countering transition-related challenges, but research has yet to systematically examine their efficacy during these stressful junctures. Past studies have consistently shown employing strategies that target cognitive and behavioral resources during goal pursuit (control striving) facilitates adaptation for individuals who experience significant challenges across the life-span (e.g.,

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Chipperfield and Perry 2006; Chipperfield et al. 2007; Haase et al. 2008, 2012; see Chipperfield et al., in press; Heckhausen et al. 2010 for reviews). Thus, cognitive (selective secondary) control strategies that sustain volitional goal commitment may be especially critical for young adults faced with the time constraints, competing goals, and initial failure inherent to the shift from school to university.

Recent evidence shows that employing these selective secondary control strategies promotes motivation, goal engagement, and goal attainment for young adults in the midst of difficult life course transitions (Hamm et al. 2013, 2015; Poulin and Heckhausen 2007). Consequently, our 7-month, pre-post, randomized field study extended previous research by assessing the efficacy of a novel and theory-driven (selective secondary) control striving treatment to improve performance for young adults facing obstacles during the challenging transition to university (Heckhausen et al. 2010). Changes in theoretically-derived process variables (selective secondary and primary control strategies) were expected to account for treatment effects on goal attainment and were examined as mediators of the treatment-performance linkage.

The effects of control striving for young adults in transition

Heckhausen and colleagues' motivational theory of life-span development (MTLD) provided a substantive conceptual framework for the development of a control striving treatment (Heckhausen and Schulz 1995; Heckhausen et al. 2001, 2010). The MTLD posits that humans commonly employ selective secondary and selective primary control strategies during goal pursuit. *Selective secondary control* comprises strategies that target internal cognitive and affective resources in order to maintain volitional goal commitment, such as downplaying conflicting goals or thinking about the pride one will experience after goal attainment. *Selective primary control* involves strategies that target behavioral resources in order to pursue goals (e.g., increasing effort, investing time on task).[1]

[1] The present literature review focuses on control striving from the perspective of the MTLD and therefore does not address motivation treatments that: involve motivation theories other than Heckhausen et al.'s (2010); are not control strategy based, for example, attributional retraining (e.g., Perry and Hamm, in press), value enhancement (e.g., Hulleman and Harackiewicz 2009; Harackiewicz et al. 2012), intention implementation (e.g., Duckworth et al. 2011), goal setting (e.g., Morisano et al. 2010), or social belonging (e.g., Walton and Cohen 2011); do not concern motivation or performance (e.g., psychotherapy); or, focus on very young or old populations (e.g., Chapin and Dyck 1976; Gitlin et al. 2006a, b). Reviews of the broader motivation treatment literature are provided elsewhere (see Elliot et al., in press; Karabenick and Urdan 2014).

Past research points to the benefits of striving for control in multiple domains and throughout the life-span: Increased control striving is related to the attainment of career goals, increased positive affect, higher job and life satisfaction, increased life purpose, less depressive symptoms, fewer physical health conditions, and better functional status for adults facing challenge across the life-span (Chipperfield et al. 1999; Chipperfield and Perry 2006; Haase et al. 2008, 2012; Hall et al. 2010; Haynes et al. 2009a). Most relevant to the present study, evidence shows that selective secondary control striving facilitates motivation and adaptation for young adults navigating difficult life course transitions. For instance, a 10-month field study by Poulin and Heckhausen (2007) found that selective secondary control striving was positively related to selective primary control striving, perceived control, and positive affect (and inversely related to negative affect) for adolescents seeking apprenticeships during the school-to-work transition. The effects of these motivation-enhancing strategies were strongest for students experiencing stressful circumstances (death of a family member or parental divorce).

Other longitudinal field studies spanning two-academic semesters (Hamm et al. 2013, 2015) replicated and extended these findings by showing that increased selective secondary control striving during the shift from high school to university predicts increased selective primary control striving over time. These motivation-enhancing strategies also predicted (a) more happiness, pride, hope; (b) less guilt, regret, helplessness, shame, and anger; (c) reduced depressive and stress-related physical symptoms; and (d) higher academic performance on class tests and final course grades assessed over a 7-month period. Consistent with MTLD theory (Heckhausen et al. 2010), the effects of selective secondary control were mediated by selective primary control striving and were most pronounced for students facing significant challenges (those with a history of poor academic performance).

This research indicates there are advantages for young adults who engage in selective secondary control striving during life course transitions, particularly for those who encounter additional obstacles to goal attainment. Although treatments designed to promote these motivation-enhancing strategies may be a viable means of facilitating adaptation for young adults in transition, a systematic evaluation of control striving treatments is lacking.

A control striving treatment to sustain motivation during life course transitions

The present study advanced the literature by assessing the efficacy of a theory-driven (selective secondary) control striving treatment to promote student performance during the school-to-university shift. Our analytic approach enabled an examination of how (mediators) and under what conditions (moderators) the treatment influenced achievement. Concerning moderation, previous intervention research in competitive achievement settings shows that motivation treatments are typically most effective for those experiencing challenge (e.g., Perry et al. 2014; Perry and Hamm, in press). This suggests transition-related risk factors may affect (moderate) control striving treatment effects. In line with theory and evidence regarding which individuals benefit from selective secondary control, treatments that promote motivation-enhancing strategies should primarily advantage those facing challenging but manageable obstacles (Heckhausen et al. 2010; Poulin and Heckhausen 2007). For young adults aspiring to complete a post-secondary education, few obstacles to goal attainment are more problematic than entering university with a low high school grade (HSG).

Those who begin university with low HSGs are commonly recognized as being at high risk of failure (see Mathiasen 1984; Mouw and Khanna 1993; and Robbins et al. 2004). A comprehensive meta-analysis conducted by Richardson, Abraham, and Bond (2012) revealed that HSG is the strongest traditional correlate of university grade point averages (GPAs, $r = .40$), predicting post-secondary achievement as well or better than SAT ($r = .29$) or ACT scores ($r = .40$). HSG has an equally strong influence on the likelihood that young adults achieve a critical developmental goal, graduating university. A 5-year field study of 1500 university students revealed that each one-unit increase in incoming HSGs ($0.0 = F$ to $4.0 = A$) more than doubled the odds of graduation after 5 years (OR = 2.76; Johnson 2008). It is noteworthy that the size of this effect was equivalent to that of first term university GPAs on graduation (OR = 2.77). Thus, unprepared young adults who enter university with low HSGs are at increased risk of failing to achieve consequential short-term (e.g., passing a class test) and long-term goals (e.g., graduating university) and may benefit from selective secondary control (SSC) treatments.

However, not all low HSG students are likely to benefit from control striving treatments. Low HSG students differ in critical psychological variables that can preserve motivational resources and may impact treatment uptake during challenging life course transitions (see Perry et al. 2014). Perceived control represents one such variable and refers to beliefs people hold about their capacity to predict or influence important events in their lives (Perry 1991, 2003). Previous research points to the protective influence of perceived control for young adults navigating stressful transitions to low control environments (Perry et al. 2005a).

Longitudinal field studies of school-to-university transitions show that perceived academic control (PAC) sustains intrinsic motivation (rs = .18 to .19; Hamm et al. 2014; Perry et al. 2001); enhances positive emotions such as pride and hope (rs = .24 to .43; Hall et al. 2006; Pekrun et al. 2004); and diminishes negative emotions including helplessness and shame (rs = −.34 to −.47; Pekrun et al. 2004; Ruthig et al. 2007). PAC also facilitates performance on year-end final course grades (rs = .21 to .27) and cumulative GPAs assessed over one (rs = .20 to .31), two ($r = .19$), and three academic years ($r = .19$; Hall et al. 2006; Perry et al. 2001, 2005b; Ruthig et al. 2007; Stupnisky et al. 2007, 2008). Highlighting its influence in competitive achievement settings, separate meta-analyses by Robbins et al. (2004) and Richardson et al. (2012) found that perceived control was the strongest psychosocial predictor of university GPAs (rs = .31 to .59).

Consequently, PAC may moderate which low HSG individuals benefit from control striving treatments. As described earlier, the transition from school to university is fraught with novel challenges that have the capacity to overwhelm even young adults who are motivated and prepared (Perry 2003). Low HSG students who also have low PAC may be most susceptible to the detrimental effects of this difficult transition and may therefore be unable to benefit from motivation treatments (see Perry and Penner 1990). This logic is consistent with Heckhausen et al.'s (2010) congruence principle, which posits that compatibility between an opportunity and a goal is essential to achieving the objective. Thus, young adults with low HSGs and low PAC may experience goal-opportunity incongruence due to pursuing overly challenging goals in a competitive and unsupportive environment. Specifically, incongruence may arise when low HSG-low PAC students begin the transition period unprepared (lack work habits, skills, content knowledge) and believe their capacity to influence academic performance is limited.[2]

Young adults with low HSGs and high PAC also face a significant obstacle to goal attainment in entering university unprepared, but believe in their abilities to influence future academic performances. Hence, low HSG-high PAC individuals may have untapped potential due to their substantial personal control that is likely to be threatened by a

[2] Comprehensive meta-analyses by Robbins et al. (2004) and Richardson et al. (2012) showed HSGs (rs = .40–.41) and PAC (rs = .31–.59) were the strongest traditional and psychosocial correlates of university performance and therefore represent two of the most influential academic risk factors in university achievement settings. This implies students with a "double-jeopardy" low HSG-low PAC risk profile are prone to academic failure and may suffer extreme motivation deficits during the school-to-university transition. A one-time SSC treatment administered in a group setting is unlikely to remedy these substantial deficits. Low HSG-low PAC students may require more intensive intervention programs involving multicomponent treatments tailored to their specific needs and administered on multiple occasions.

lack of educational preparation in high school. These students may be receptive to (selective secondary) control striving treatments designed to sustain volitional goal commitment when facing obstacles and setbacks. Thus, SSC treatments may be able to assist low HSG-high PAC students by providing a timely boost to motivational resources and thereby maintain elevated levels of goal engagement to overcome (a) challenges inherent in the transition to university that are compounded by (b) the obstacles posed by deficits in skill, knowledge, and work habits.

According to theory and research (Hamm et al. 2013; Heckhausen et al. 2010), the effects of SSC treatments on goal attainment should be indirect (mediated) through several influential psychological process variables. Logically, a treatment designed to enhance selective secondary control should promote the employment of these motivation-enhancing strategies. Further, the MTLD contends that selective secondary control ultimately serves to promote selective primary control striving (Heckhausen et al. 2010). Recent evidence supports this proposition and shows that selective primary control mediates the influence of selective secondary control on academic performance in a two-semester course (Hamm et al. 2013). Thus, the effect of SSC treatments on performance may be accounted for (mediated) by a sequence of mechanisms comprising selective secondary and selective primary control striving.

Our two-semester, pre-post, randomized field study assessed the efficacy of a novel theory-driven SSC treatment in assisting young adults during the school-to-university transition. For low HSG-high PAC students, the SSC treatment (vs. no-treatment) was expected to promote post-treatment selective secondary control and year-end academic performance. The SSC treatment-performance linkage was expected to be mediated by psychological process variables consistent with Heckhausen et al.'s MTLD (2010). We predicted that, for low HSG-high PAC students, (a) the SSC treatment (vs. no-treatment) would directly promote selective secondary control, (b) increases in this form of motivation-enhancing thinking would facilitate selective primary control striving, and (c) increases in selective primary control would predict higher year-end academic performance (see Fig. 1).

A supplemental objective was to examine whether discrete emotions further mediated SSC treatment effects on performance. Previous research shows selective primary control striving promotes emotional well-being (Hamm et al. 2015; Haynes et al. 2009a), which in turn predicts academic performance (Pekrun et al. 2004, 2009). Thus, we expected positive (pride, hope) and negative (helplessness, shame) discrete emotions to mediate the selective primary control-academic performance path tested in the main analysis.

Method

Participants and procedures

The sample consisted of young adults ($n = 316$) enrolled in a research-intensive university in Western Canada who were native English speakers in their first year of university, the majority of whom were 17–18 year old (89 %) females (68 %). They were recruited from multiple sections of an introductory psychology course and participated in a pre-post, quasi-experimental, randomized treatment field study in exchange for partial course credit. Data were collected at four time points over a 7-month period during the academic year.

At Time 1 (October), participants selected laboratory-based study sessions that were randomly assigned to experimental treatment conditions (Shadish et al. 2002). Participants began the first laboratory study session by completing an online questionnaire. Time 2 occurred immediately following the Time 1 questionnaire: As described below, participants in the experimental sessions received the SSC treatment whereas those in the control sessions completed a filler task. At Time 3 (March), participants returned to the laboratory to complete a second online questionnaire similar to the first questionnaire. Time 4 (May) consisted of acquiring participants' final course grades from their introductory psychology course after the second semester concluded.

Main study variables

High school grade (HSG; Time 1)

Self-reported HSG was used as a proxy for actual high school performance based on a strong relation between the two, $r = .84$ (Perry et al. 2005b; 1 = *50 % or less*, 10 = *91–100 %*; $M = 8.10$, $SD = 1.50$, range = 2–10). Previous research has demonstrated that this self-report measure of HSG is a reliable and substantial predictor of post-secondary achievement, including final course grades, $r = .40–.54$; and grade point averages, $r = .51–.54$ (e.g., Hamm et al. 2014; Perry et al. 2001, 2005b, 2010). Canadian universities use HSGs as the primary admission criterion rather than standardized entrance examinations (e.g., SATs, ACTs). Meta-analyses by Richardson et al. (2012) and Robbins et al. (2004) revealed that HSGs are the strongest traditional correlate of university GPAs (*r*s = .40 to .41) and predict university performance as well or better than SAT ($r = .29$ to .37) or ACT scores ($r = .37$ to .40). See Table 1 for a summary of the main study variables.

Perceived academic control (Time 1)

Perry et al.'s (2001) 8-item perceived academic control (PAC) scale assessed domain-specific perceived control at

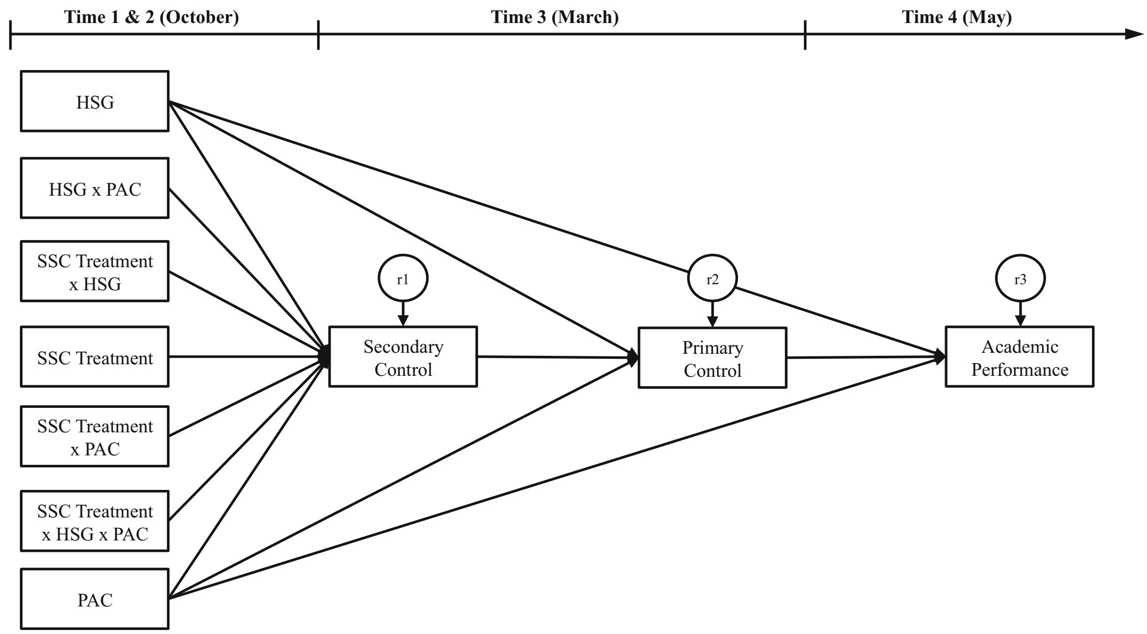

Fig. 1 Structural model displaying all specified paths in the hypothesized sequence. All effects were adjusted for age and gender. *HSG* high school grade, *PAC* perceived academic control, *r* residual

Time 1 (e.g., "I have a great deal of control over my academic performance in my Introductory Psychology course"). Participants rated their agreement on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*; $M = 4.11$, $SD = 0.59$, range = 1.75–5.00, $\alpha = .80$). PAC was reassessed using the same scale at Time 3 ($M = 4.14$, $SD = 0.56$, range = 2.63–5.00, $\alpha = .79$, test–retest $r = .59$).

Previous research indicates the PAC scale has suitable psychometric properties ($\alpha = .75$ to .81; 5-month test–retest reliability $r = .53$ to .66; Hall et al. 2006; Pekrun et al. 2010; Perry et al. 2001, 2005b; Ruthig et al. 2009; Stupnisky et al. 2008). Past studies have also established the PAC scale is a reliable predictor of post-secondary achievement, including final course grades, $r = .27$–.29; and year-end grade point averages, $r = .19$–.31 (Perry et al. 2001, 2005b; Ruthig et al. 2007; Stupnisky et al. 2007).

Selective secondary control treatment (SSC treatment; Time 2)

The SSC treatment was administered early during the transition period (October) and immediately following the Time 1

Table 1 Summary of the main study variables and zero-order correlation matrix

	M	*SD*	Actual range	α	1	2	3	4	5	6	7	8	9
1. Age[a]	1.11	0.32	1–2	–	–								
2. Gender[a]	1.32	0.47	1–2	–	.03	–							
3. HSG[a]	8.10	1.50	2–10	–	−.16*	−.11*	–						
4. PAC[a]	4.11	0.59	1.75–5.00	.80	.08	.05	.09	–					
5. Secondary control[b]	4.14	0.57	2.50–5.00	.68	−.05	−.09	.12*	.17*	–				
6. Primary control[b]	3.98	0.67	1.75–5.00	.81	−.02	−.11	.29*	.10	.61*	–			
7. Positive emotions[b]	6.48	1.87	1.50–10.00	–	.01	−.01	.16*	.16*	.38*	.40*	–		
8. Negative emotions[b]	3.24	1.96	1.00–9.00	–	−.03	−.03	−.26*	−.17*	−.10	−.27*	−.46*	–	
9. Academic performance[c]	72.01	12.79	10.11–94.65	–	−.06	−.04	.48*	.22*	.31*	.33*	.40*	−.40*	–

HSG high school grade, *PAC* perceived academic control

[a] Time 1 measure

[b] Time 3 measure

[c] Time 4 measure

* $p \leq .05$ (two-tailed tests)

questionnaire. The treatment was provided by trained research assistants in a laboratory setting equipped with computers for each participant. Treatment administration occurred during 1-hour sessions and consisted of three stages. First, the *activation* stage had students reflect on the causes of past academic performances to heighten the relevance of the treatment content (see Perry et al. 2014). Activation was accomplished by having participants rate the influence of various causes to their academic performance presented via a secure survey website, as well as by administering the treatment only after students had received performance feedback on their first introductory psychology test.

Second, the *induction* stage required participants to view a narrated video presentation that focused on the grade-enhancing impact of employing selective secondary control strategies. Based on Heckhausen et al.'s MTLD (Heckhausen and Schulz (1995); Heckhausen et al. 2010), the narrated presentation suggested that (a) students who set academic goals tend to achieve higher grades, (b) maintaining motivation for academic goals is challenging, and (c) students who actively focus on sustaining their goal commitment by employing selective secondary control strategies are more likely to achieve their long-term academic goals. Selective secondary control strategies were introduced using the acronym *APP* to provide students with a simple mnemonic to facilitate retention of the treatment message. APP/selective secondary control 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 in the face of obstacles and initial setbacks).

Third, the *consolidation* stage used a writing activity that was designed to facilitate deep processing of the treatment content based on previous research (see Haynes et al. 2009b 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 sessions completed the same activation activity described above. However, during the critical induction and consolidation stages, those in the no-treatment sessions completed "filler" tasks. In the induction stage, participants viewed a narrated presentation summarizing supplemental information from their introductory psychology course textbook. Presentation content focused on how artists throughout history have employed perceptual principles to recreate, reinterpret, and question reality. The consolidation phase involved participants summarizing the presentation and writing about how they could apply the main points of the presentation in their own lives. The treatment variable was dummy-coded (0 = *no-treatment* [$n = 205$], 1 = *SSC treatment* [$n = 111$]).

Selective secondary control strategies (Time 3)

Four items from the domain-specific Academic-Specific Control Strategies scale measured selective secondary control at Time 3 (ASCS; Hamm et al. 2013; e.g., "I often tell myself that I will be successful in reaching my educational goals"). Participants rated their agreement on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*; $M = 4.14$, $SD = 0.57$, range = 2.50–5.00, $\alpha = .68$). Selective secondary control was assessed using the same scale at Time 1 ($M = 4.23$, $SD = 0.58$, range = 1.25–5.00, $\alpha = .63$, test–retest $r = .45$).

Confirmatory factor analyses conducted by Hamm et al. (2013) indicate that the items comprising the selective secondary and selective primary control measures form satisfactory psychometric scales that conform to their theoretical underpinnings. Research assessing the 5-month test–retest reliability of the selective secondary control subscale has demonstrated acceptable stability over time, $r = .61$ (Hamm et al. 2015).

Selective primary control strategies (Time 3)

Four domain-specific items from the ASCS scale measured selective primary control at Time 3 (e.g., "I will work hard to get a good education). Participants rated their agreement on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*; $M = 3.98$, $SD = 0.67$, range = 1.75–5.00, $\alpha = .81$). Selective primary control was assessed using the same scale at Time 1 ($M = 4.00$, $SD = 0.72$, range = 1.00–5.00, $\alpha = .82$, test–retest $r = .57$). Hamm et al. (2015) also examined the 5-month test–retest reliability of the selective primary control subscale and found acceptable stability over time, $r = .63$.

Academic performance (Time 4)

Academic performance was measured using final grades (percentages) in an introductory psychology course (with possible values from 0 to 100 %; $M = 73.68$, $SD = 13.26$, range = 7.16–96.18). The measure was adjusted for (omitted) scores on a pre-treatment class test. Grades were collected from instructors at the end of the academic year.

Covariates

Age (Time 1)

Participants indicated their age using a 10-point scale (1 = *17–18*, 10 = *older than 45*; $M = 1.11$, $SD = 0.32$, range = 1–2).

Gender (Time 1)

Gender was coded categorically (1 = *female*, 2 = *male*; 68 % female).

Emotion measures for the supplemental analysis

Positive emotion (Time 3)

Participants reported their pride and hope after reading the following stem: "Please indicate the extent to which each of the following emotions describe how you feel about your performance in your introductory psychology course to date." Time 3 ratings were provided on a 10-point scale (1 = *not at all*, 10 = *very much so*; $M = 6.48$, $SD = 1.87$, range = 1.50–10.00, pride-hope $r = .66$). Positive emotions were assessed using the same items at Time 1 ($M = 5.86$, $SD = 1.87$, range = 1.00–10.00, pride-hope $r = .47$, test–retest $r = .45$)

Negative emotion (Time 3)

Participants reported their helplessness and shame after reading the same stem as that described for the positive emotions. Time 3 ratings were provided on a 10-point scale (1 = *not at all*, 10 = *very much so*; $M = 3.24$, $SD = 1.96$, range = 1.00–9.00, helplessness-shame $r = .54$). Negative emotions were assessed using the same items at Time 1 ($M = 3.57$, $SD = 2.14$, range = 1.00–10.00, helplessness-shame $r = .46$, test–retest $r = .34$).

Results

A Treatment x HSG x PAC design tested the hypotheses. Simple slope regression analyses assessed whether the SSC treatment influenced post-treatment selective secondary control and two-semester academic performance for low HSG-high PAC students in transition. A path analytic and moderated mediation approach examined whether SSC treatment effects on performance (for low HSG-high PAC students) were mediated by a hypothesized sequence of psychological mechanisms based on Heckhausen et al. (Heckhausen and Schulz 1995; Heckhausen et al. 2010; see Fig. 1). Details concerning the path analytic approach are provided in describing the results. Consistent with previous treatment intervention studies in competitive achievement settings (e.g., Hamm et al. 2014; Haynes Stewart et al. 2011), age and gender were controlled in all analyses to account for the extraneous influence of these demographic factors on motivation and performance outcomes (see Richardson et al. 2012).

Standardized regression weights are reported for all effects with the exception of the treatment effects. Because the treatment variable is dichotomous, it has been left in its original metric (0 = *no-treatment*, 1 = *SSC treatment*) to enable valid interpretation (Hayes 2013). Hence, SSC treatment effects are partially standardized and represent the mean difference between the no-treatment and SSC conditions on the dependent measures reported in standard deviation units (e.g., the standard deviation difference between the treatment conditions in academic performance). Note that a partially standardized beta weight is conceptually analogous to Cohen's *d*. Thus, the partially standardized effect of SSC treatment ($\beta = .62$) on academic performance reported below indicates that low HSG-high PAC students who received treatment outperformed their no-treatment peers by .62 of a standard deviation (74.85 % vs. 66.68 %). To simplify the presentation of our findings, selective secondary control and selective primary control are respectively referred to as *secondary control* and *primary control* throughout the results section.

Random assignment to treatment conditions

In keeping with quasi-experimental, randomized treatment design principles (Shadish et al. 2002), students signed up for laboratory-based experimental sessions that were randomly assigned to treatment conditions (SSC treatment, no-treatment). The efficacy of the random assignment procedure was assessed using independent sample *t* tests. Results showed the SSC treatment and no-treatment conditions did not differ with respect to pre-treatment demographic (gender, age), psychosocial (PAC, secondary control, primary control, positive emotion, negative emotion), or performance (HSG, Test 1) variables at $p < .01$.

Zero-order correlations

Correlation coefficients allowed for an examination of unadjusted relationships between the study variables (see Table 1). HSG ($r = .48$), PAC ($r = .22$), secondary control ($r = .31$), primary control ($r = .33$), and positive ($r = .40$) and negative ($r = -.40$) emotions were related to academic performance in theoretically consistent directions. HSG was correlated with secondary control ($r = .12$), primary control ($r = .29$), and positive ($r = .16$) and negative emotion ($r = -.26$), whereas PAC was correlated with secondary control ($r = .17$) and positive ($r = .16$) and negative emotion ($r = -.17$).[3] As expected,

[3] Although PAC should relate to student grades, it may not correlate with HSGs considering that the PAC items were context-specific and referred to students' university experiences (see Perry et al. 2001).

secondary and primary control were strongly and positively related to each other ($r = .61$). Secondary control also correlated with positive emotions ($r = .38$), whereas primary control correlated with both positive ($r = .40$) and negative emotions ($r = -.27$). Positive and negative emotions were strongly related to each other ($r = -.46$).

Simple treatment effects

Treatment x HSG x PAC regression models assessed whether the SSC treatment (vs. no-treatment) influenced post-treatment psychological (Time 3 secondary control) and performance (Time 4 final grades) outcomes consistent with theory (Heckhausen et al. 2010). Three-way interactions were observed for secondary control [$\beta = -.20$, $p < .001$, CIs $= -0.305$ to -0.087] and performance [$\beta = -.09$, $p = .023$, CIs $= -0.173$ to -0.013]. Interactions were probed by testing simple–simple treatment effects (slopes) at low (-1 SD) and high ($+1$ SD) levels of HSG and PAC using the lavaan package for R (Cohen et al. 2003; Hayes 2013; Rosseel 2012). Thus, SSC treatment effects were tested at four combinations of the moderators: low HSG-low PAC, low HSG-high PAC, high HSG-low PAC, and high HSG-high PAC.

Simple-simple slope regression analyses showed that low HSG-high PAC students in the SSC treatment condition reported higher secondary control than their peers in the no-treatment condition 5-months post-treatment [partially standardized $\beta = .73$, $p = .003$, CIs $= 0.257$ to 1.211]. Tests of simple–simple slopes also indicated that low HSG-high PAC individuals who received SSC treatment achieved year-end course grades that were 8 % higher (74.85 % vs. 66.68 %) than their no-treatment peers [partially standardized $\beta = .62$, $p = .002$, CIs $= 0.226$ to 1.007; see Fig. 2). Effects were consistent when controlling for baseline levels of each outcome measure (i.e., when accounting for autoregressive effects of T1 secondary control and initial test performance).[4] No treatment effects were observed for students with the other three combinations of HSG and PAC (p range $= .082$ to $.758$).[5]

Supplemental analyses also probed Treatment x HSG x PAC interactions employing a traditional approach that tested simple–simple SSC treatment effects within subgroups of students characterized by low (below median) or high (above median) HSGs and PAC. Results of these simple–simple effect t-tests were consistent with those reported above. Only low HSG-high PAC individuals who received the SSC treatment reported higher post-treatment secondary control [$t(239) = 3.16$, $p = .002$, $Ms = 4.48$ vs. 4.02, $M_{diff} = 0.46$, $d = 0.84$] and achieved higher final grades [$t(306) = 2.03$, $p = .044$, $Ms = 76.53$ vs. 70.94, $M_{diff} = 5.60$, $d = 0.48$] than their no-treatment peers (see Table 2 for group means and standard deviations).[6]

Main path analysis

The main path analyses tested whether SSC treatment effects on two-semester performance were mediated by psychological process variables based on Heckhausen et al. (Heckhausen and Schulz 1995; Heckhausen et al. 2010; see Fig. 1). A path analytic approach involving the lavaan package for R (maximum-likelihood method; Rosseel 2012) was used to calculate the omnibus effects of predictor variables and test model fit. Model fit was assessed using Chi square (χ^2), the comparison fit index (CFI), and the root mean square error of approximation (RMSEA) based on recommendations by Byrne (2010). Results of these tests indicated that the model fit the data well: χ^2 $(11) = 17.83$, $p = .086$; CFI $= .974$; RMSEA $= .044$.

Footnote 3 continued
This implies that PAC should positively relate to university performance but may not relate to past HSGs given (a) shifts in perceptions of control during the major school-to-university transition and (b) the significant differences between high school and university achievement settings (see Perry 2003; Perry et al. 2001, 2005a).

[4] SSC treatment effects were consistent when accounting for autoregressive effects of T1 secondary control and initial test performance. For only low HSG-high PAC students, the SSC treatment (vs. no-treatment) increased (a) Time 3 secondary control when controlling for Time 1 secondary control (partially standardized $\beta = .52$, $p = .021$) and (b) final course grades when controlling for initial test performance [partially standardized $\beta = .36$, $p = .036$].

[5] To test Heckhausen et al.'s (2010) proposition that SSC should promote perceived control, we conducted a supplemental Treatment x HSG x PAC regression analysis with Time 3 PAC as the outcome measure when controlling for age and gender. The three-way interaction was significant ($\beta = -.12$, $p = .009$, CIs $= -0.207$ to -0.030), and simple–simple slope analyses indicated that the SSC treatment (vs. no-treatment) increased Time 3 PAC for individuals with low HSGs and high Time 1 PAC (partially standardized $\beta = .49$, $p = .014$, CIs $= 0.097$ to 0.873). The SSC treatment also increased Time 3 PAC for those with high HSGs and low Time 1 PAC (partially standardized $\beta = .64$, $p = .002$, CIs $= 0.234$ to 1.040). No treatment effects were observed for students with the remaining two combinations of HSG and PAC. Results were consistent when employing a traditional subgroups approach: The SSC treatment (vs. no-treatment) only increased Time 3 PAC for students with low HSGs and high initial PAC [$t(238) = 2.31$, $p = .022$, $Ms = 4.66$ vs. 4.38, $M_{diff} = 0.28$, $d = 0.61$] and for students with high HSGs and low initial PAC [$t(238) = 1.98$, $p = .048$, $Ms = 4.13$ vs. 3.87, $M_{diff} = 0.25$, $d = 0.54$].

[6] Although treatment conditions and experimental sessions were homogenous on the pre-treatment (baseline) variables, supplemental multi-level analyses were conducted to account for potential group effects by nesting students within (a) course tutorial sections and (b) experimental sessions based on recommendations by Tabachnick and Fidell (2013). SSC treatment effects on each of the outcome measures (secondary control, PAC, final grades) were consistent in both sets of multi-level analyses.

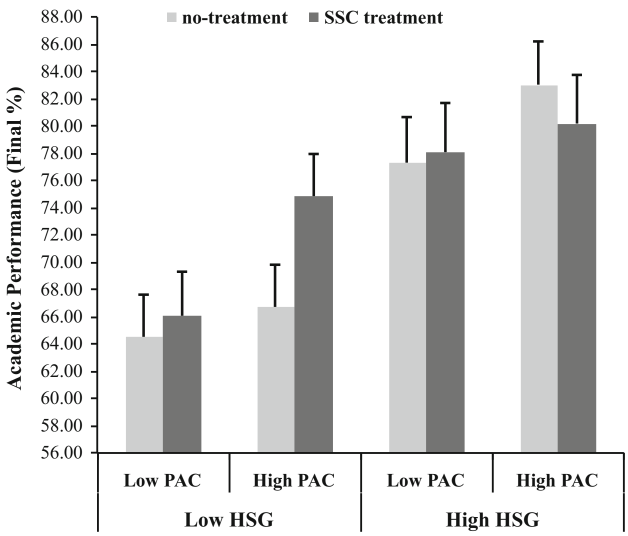

Fig. 2 The Treatment x high school grade (HSG) x perceived academic control (PAC) interaction on two-semester academic performance. Simple-simple effects of SSC treatment (vs. no-treatment) are presented at low (−1 *SD*) and high (+1 *SD*) levels of HSG and PAC based on the regression analyses. *Error bars* represent 1 standard error

Individual path estimates (regression weights) revealed a pattern of results consistent with the proposed model (see Table 3). Note that the variables involved in the hypothesized interactions (SSC treatment, HSG, PAC) were mean centered to facilitate interpretation of their omnibus effects (Cohen et al. 2003). HSG [β = .18, $p = .007$, CIs = 0.050 to 0.308], PAC [β = .19, $p = .005$, CIs = 0.056 to 0.314] and the Treatment x HSG x PAC interaction [β = −.20, $p < .001$, CIs = −0.305 to −0.087] were significant predictors of secondary control. The significant three-way interaction was probed using lavaan (Rosseel 2012) to examine SSC treatment effects at low (−1 SD) and high (+1 SD) levels of HSG and PAC. Consistent with the hypotheses, simple–simple slope analyses showed that students with low HSGs and high PAC who received the SSC treatment reported higher secondary control than their no-treatment peers [partially standardized β = .73, $p = .003$, CIs = 0.257 to 1.211]. Effects were consistent when controlling for baseline (T1) secondary control. No treatment effects were observed for those with the remaining three combinations of HSG and PAC (p range = .082 to .742).

Supporting the proposed model, secondary control was a strong predictor of primary control (β = .59, $p < .001$, CIs = 0.492 to 0.691). HSG also predicted primary control (β = .25, $p < .001$, CIs = 0.145 to 0.349). Results were consistent when accounting for autoregressive effects (i.e., adjusting for T1 primary control). Because the SSC treatment predicted secondary control (for low HSG-high PAC students only), which in turn predicted primary control, we tested whether the SSC treatment had conditional indirect effects on primary control via secondary control. Conditional indirect treatment effects were tested at low (−1 SD) and high (+1 SD) levels of HSG and PAC and tested for significance using a bootstrap approach that employed 95 % bias corrected confidence intervals (Hayes 2013; Preacher and Hayes 2008). Mediation was confirmed if zero fell outside the confidence interval (CI) based on 5,000 samples of the unstandardized beta weights. The indirect effects of omnibus predictors were tested using the same bootstrap approach. As expected, the SSC treatment

Table 2 Means and standard deviations by SSC treatment condition, high school grade, and perceived academic control

Outcome	Low HSG				High HSG			
	Low PAC		High PAC		Low PAC		High PAC	
	No-SSC	SSC	No-SSC	SSC	No-SSC	SSC	No-SSC	SSC
Secondary control[a]								
M (SD)	4.01 (0.48)	3.92 (0.58)	4.02 (0.61)	4.45 (0.42)	4.08 (0.60)	4.22 (0.52)	4.39 (0.54)	4.18 (0.61)
Adj. M (SE)	3.99 (0.08)	3.94 (0.11)	4.02 (0.09)	4.48 (0.11)	4.07 (0.08)	4.21 (0.13)	4.39 (0.09)	4.18 (0.13)
n	48	25	35	26	43	19	35	18
Academic performance[a]								
M (SD)	65.35 (14.61)	66.37 (12.92)	70.86 (10.80)	76.09 (9.73)	78.92 (11.51)	79.49 (9.23)	82.18 (8.77)	81.68 (9.77)
Adj. M (SE)	65.19 (1.40)	66.42 (1.94)	70.94 (1.68)	76.53 (2.20)	78.80 (1.70)	79.24 (2.34)	82.21 (1.82)	81.66 (2.54)
n	69	36	48	29	47	25	41	21

Means and standard deviations are based on the supplemental subgroups analysis. *Adj. M* covariate adjusted mean, *HSG* high school grade, *PAC* perceived academic control, *No-SSC* no-treatment condition, *SSC* SSC treatment condition

[a] Time 3 measure

[b] Time 4 measure

Table 3 Summary of individual path estimates (regression weights)

Predictor variables	Outcome variables		
	Secondary control	Primary control	Academic performance
SSC Treatment x HSG x PAC[a]			
SSC at low HSG-low PAC	−.08	–	–
SSC at low HSG-high PAC	.73*	–	–
SSC at high HSG-low PAC	.38	–	–
SSC at high HSG-high PAC	−.44	–	–
HSG	.18*	.25*	.38*
PAC	.19*	.00	.15*
Secondary control		.59*	–
Primary control			.25*

Simple effects of the SSC treatment are presented at each of the four combinations of HSG (low, high) and PAC (low, high). Only path estimates specified in the structural model are shown (see Fig. 1). Paths not specified are indicated by a dash (–). *HSG* high school grade, *PAC* perceived academic control

[a] Standardized regression weights are reported for all variables with the exception of the SSC treatment. Because the treatment variable is dichotomous, it has been left in its original metric (0 = no-treatment, 1 = SSC treatment) to enable valid interpretation (see Hayes 2013)

* $p \leq .05$ (two-tailed tests)

Table 4 Tests of indirect effects

Predictor variable	Mediating variable(s)	Outcome variable	Standardized indirect effect[a]	95 % bias-corrected CIs (lower, upper)[b]
SSC Treatment x HSG x PAC[a]				
SSC at low HSG-low PAC	Secondary control	Primary control	−.03	−.246, .148
SSC at low HSG-high PAC	Secondary control	Primary control	.42*	.111, .468
SSC at high HSG-low PAC	Secondary control	Primary control	.24	−.030, .360
SSC at high HSG-high PAC	Secondary control	Primary control	−.26	−.393, .017
Secondary control	Primary control	Academic performance	.15*	1.466, 6.075

Simple indirect effects of the SSC treatment are presented at each of the four combinations of HSG (low, high) and PAC (low, high). *HSG* high school grade, *PAC* perceived academic control

[a] Standardized indirect effects are reported for all variables with the exception of the SSC treatment. Because the treatment variable is dichotomous, it has been left in its original metric (0 = no-treatment, 1 = SSC treatment) to enable valid interpretation (see Hayes 2013)

[b] Confidence intervals are based on 5000 samples of the unstandardized beta weights

* $p \leq .05$ based on unstandardized bias-corrected CIs (two-tailed tests)

promoted primary control through secondary control (partially standardized $\beta = .42$, CIs = 0.111 to 0.468) for only those with low HSGs and high PAC. See Table 4 for a summary of indirect effects.

Consistent with the model, higher HSGs ($\beta = .38$, $p < .001$, CIs = 0.272 to 0.482), PAC ($\beta = .15$, $p = .002$, CIs = 0.053 to 0.243), and primary control ($\beta = .25$, $p < .001$, CIs = 0.130 to 0.372) were related to increased final grades. Secondary control also indirectly promoted academic performance via primary control ($\beta = .15$, CIs = 1.466 to 6.075). All effects except the PAC-performance path remained significant when controlling for initial test performance. See Fig. 3 for a summary of the SSC treatment's indirect effects on two-semester academic performance via the proposed sequence of psychological mechanisms.

Supplemental emotions path analysis

A supplemental path analysis assessed whether emotions further mediated SSC treatment effects based on recent evidence suggesting the influence of control striving on performance may be partially accounted for by emotional well-being (Hamm et al. 2015). The structural model for the supplemental analysis was specified in accordance with the model depicted in Fig. 1. The only distinction was that the supplemental analysis included positive (pride, hope) and negative (helplessness, shame) emotions as mediators

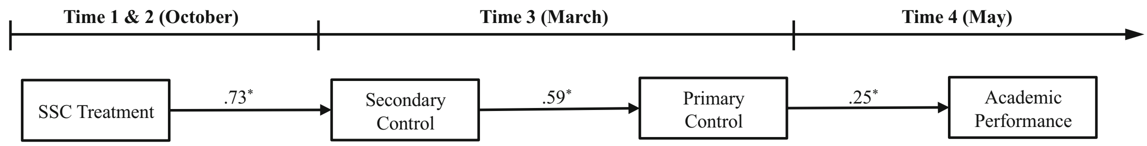

Fig. 3 Indirect effects of the SSC treatment (vs. no-treatment) on academic performance for young adults with low high school grades (HSGs) and high perceived academic control (PAC) via the proposed sequence of psychological mechanisms. All effects control for age and gender

of primary control's effects on academic performance. Age and gender were controlled in the analyses.

Results from the supplemental path analysis indicated the model had acceptable fit: χ^2 (23) = 44.59, p = .004; CFI = .948; RMSEA = .055. Note that path estimates in the supplemental model relating to the prediction of secondary control and primary control are identical to those in the main analysis. Thus, we report only path estimates involving the prediction of the emotions and academic performance below.

Consistent with the proposed model, primary control predicted both positive ($\beta = .41$, $p < .001$, CIs = 0.285 to 0.533) and negative emotion ($\beta = -.23$, $p < .001$, CIs = −0.361 to −0.106). Effects were consistent when controlling for baseline (T1) positive and negative emotion. In turn, increases in positive emotion ($\beta = .23$, $p < .001$, CIs = 0.103 to 0.358) were related to higher final grades, whereas increases in negative emotion ($\beta = -.20$, $p = .002$, CIs = −0.328 to −0.075) were related to lower final grades. Primary control also indirectly promoted academic performance via positive ($\beta = .09$, CIs = 0.739 to 3.642) and negative emotion ($\beta = .05$, CIs = 0.247 to 2.177). All effects remained consistent when controlling for initial test performance. See Fig. 4 for a summary of the SSC treatment's indirect effects on academic performance via the control strategies and emotions.

Discussion

Life course transitions are infused with changes and challenges that can undermine motivation and goal engagement (Perry 2003). These challenges may be considerable for those facing additional obstacles to goal attainment (Heckhausen et al. 2010). Motivation-enhancing treatments to promote control striving may assist some of these vulnerable individuals who have psychosocial characteristics that make them amenable to treatment. Consequently, the present 7-month, pre-post, randomized field study examined whether young adults with untapped potential (low HSG-high PAC) who were transitioning to university benefited from a novel control striving treatment. In so doing, we simultaneously examined whether treatment effects were mediated by psychological mechanisms consistent with Heckhausen et al.'s (2010) MTLD.

Results were consistent with our hypotheses and suggested that, for only young adults with low HSGs and high PAC, (a) the SSC treatment (vs. no-treatment) promoted selective secondary control, (b) increases in this form of motivation-enhancing thinking facilitated selective primary control striving, (c) which in turn predicted higher year-end academic performance. Results of the supplemental path analysis extend the main findings and contribute to a broader understanding of motivational processes accounting for the

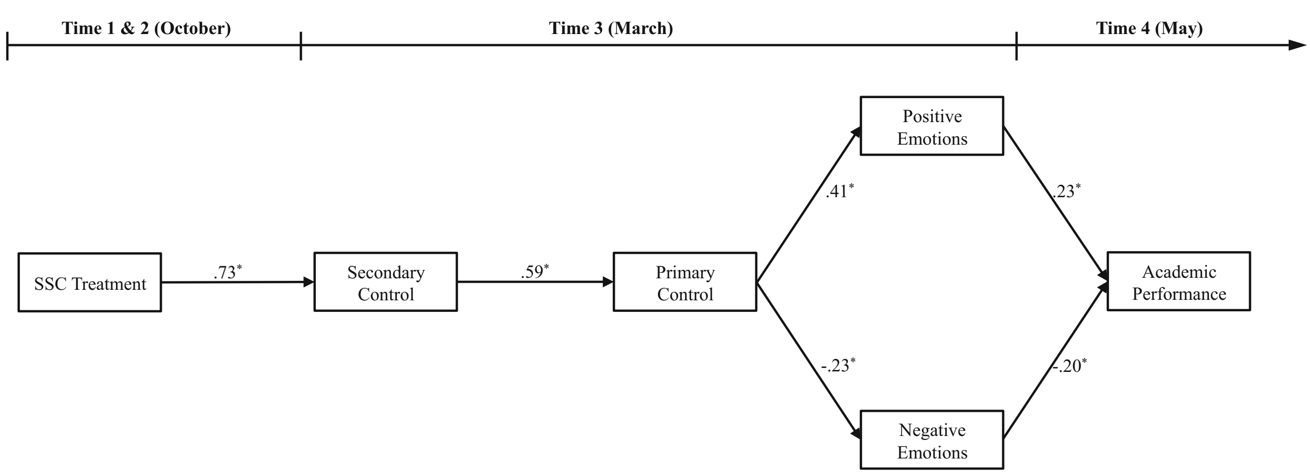

Fig. 4 Supplemental analysis showing indirect effects of the SSC treatment on academic performance for young adults with low high school grades (HSGs) and high perceived academic control (PAC) via the control strategies and emotions. All effects control for age and gender

influence of control striving treatments on performance. These findings build on evidence linking selective primary control to emotional well-being (Hamm et al. 2015; Haynes et al. 2009a) by showing that positive (pride, hope) and negative (helplessness, shame) discrete emotions mediated the selective primary control-academic performance path examined in the main analysis. Thus, in line with Heckhausen et al.'s (2010) theoretical propositions, the treatment directly increased the use of cognitive control strategies and indirectly promoted adaptive emotions, which in turn facilitated two-semester performance. These findings advance the literature by showing that control striving treatments influence performance for some young adults with untapped potential (low HSG-high PAC) and by demonstrating that the treatment-performance linkage is mediated by psychological mechanisms consistent with Heckhausen et al.'s MTLD (1995, 2010).

Standardized predicted values (Z_{PRED}) from the preliminary analyses point to the SSC treatment's capacity to tap the potential of young adults with low HSGs and high PAC. Those who did not receive treatment reported modest levels of post-treatment selective secondary control ($Z_{PRED} = -.28$) and PAC ($Z_{PRED} = .30$), which may have contributed to their poor long-term performance ($Z_{PRED} = -.53$). These 5–7-month psychological and performance outcomes are in contrast to those experienced by their peers who received SSC treatment: Young adults with low HSGs and high PAC in the treatment condition reported the highest post-treatment selective secondary control ($Z_{PRED} = .45$), the highest PAC ($Z_{PRED} = .79$), and achieved average final grades ($Z_{PRED} = .09$). Thus, low HSG-high PAC students in the treatment condition were able to sustain their motivation-enhancing thinking (selective secondary control) and adaptive beliefs about their academic capabilities (PAC) over a 5-month period to a greater degree than even high HSG-high PAC students who were least at risk (respective $Z_{PRED} = .01$ and .59). Although low HSG-high PAC students did not achieve the highest final grades, their performance was significantly higher than their no-treatment peers and comparable to those with high HSGs and low PAC ($Z_{PRED} = .27$).[7]

The magnitudes of these SSC treatment effects for low HSG-high PAC students were moderate in size based on Cohen's (1988) conventions and noteworthy considering our 7-month field design (note that a partially standardized β is conceptually analogous to Cohen's *d*). For instance, the partially standardized treatment effect (β = .62) on year-end course grades indicates low HSG-high PAC students in the SSC treatment condition outperformed their no-treatment peers by .62 of a standard deviation. This 8 % boost (74.85 % vs. 66.68 %) for those receiving the SSC treatment is consequential given that it translates into a full letter grade difference in an 8-month course (C+ vs. B). SSC treatment effects on selective secondary control (partially standardized β = .73) and PAC (partially standardized β = .49) assessed 5-months post-treatment were consistent with the performance effect and moderate in size.

Considering that the SSC treatment was administered in a single one hour session, it is notable that the magnitude of the treatment's effect on performance (partially standardized β = .62 converted into Pearson's $r = .28$) compares favorably to costly and time-intensive first-year experience ($r = .02$), academic skill ($r = .28$), and self-management ($r = .16$) interventions increasingly provided to young adults transitioning to university (see meta-analysis by Robbins et al. 2009). At a surface level, the capacity of a one-time control striving treatment to produce meaningful effects on performance assessed 7-months post-treatment may appear surprising. However, these results are consistent with research showing precise motivation treatments, such as attributional retraining (AR), that target influential psychological processes can produce notable long-term performance gains for individuals facing obstacles to goal attainment (see Cohen et al. 2009; Paunesku et al. 2015; Perry and Hamm, in press; Walton 2014; Yeager et al. 2014). Increasing evidence suggests that selective secondary control may represent one such influential factor to the extent that it facilitates adaptation by sustaining motivation, goal engagement, and well-being for young adults navigating challenging life course transitions (Hamm et al. 2013, 2015; Poulin and Heckhausen 2007). Thus, our results provide further evidence for the benefits of this form of motivation-enhancing thinking in young adulthood and suggest that these strategies are amenable to manipulation via a theoretically-based treatment intervention.

It is also interesting to note that control striving treatments based on Heckhausen et al.'s (Heckhausen and Schulz 1995; Heckhausen et al. 2010) MTLD have some parallels to attribution-based treatments based on Weiner's (1985, 2012) attribution theory of motivation and emotion. The present study and previous attributional retraining (AR) research (Haynes et al. 2006) show both SSC and AR protocols can increase perceived control and performance for young adults. However, theory suggests that changes in distinct psychological processes should account for (mediate) these treatment effects. SSC protocols may promote perceived control and performance by increasing the use of selective secondary and selective primary control strategies

[7] Predicted values were consistent with the supposition that low HSG-low PAC students may be most susceptible to the detrimental effects of difficult transitions and possibly cannot be assisted by motivation treatments: Irrespective of treatment condition, these young adults reported the lowest selective secondary control ($Z_{PRED} = -.33, -.42$), the lowest PAC ($Z_{PRED} = -.74, -.67$), and achieved the lowest final grades ($Z_{PRED} = -.69, -.58$).

(see Heckhausen et al. 2010), whereas AR may affect these outcomes by fostering adaptive explanatory reasoning (see Weiner 2012). Thus, although both protocols can increase perceived control and performance, SSC and AR are precise treatments that differ at both a theoretical and conceptual level since they are underpinned by distinct motivation frameworks (Heckhausen et al. 2010 vs. Weiner 2012) and are intended to directly alter unique psychological processes (control strategies vs. attributions).

Strengths, limitations, and future directions

One strength of our study was its reliance on the strong theoretical framework provided by Heckhausen et al.'s (Heckhausen and Schulz 1995, Heckhausen et al. 2010) MTLD, which has received consistent empirical support for its core tenets over the past 20 years. This study is also supported by a 7-month, pre-post, randomized treatment design in which a combination of psychological and performance outcomes were assessed at three separate time points during the year (October, March, May). Such designs make causal inference more viable than research that examines cross-sectional relationships or fails to manipulate the independent variables. Finally, our statistical approach (path analysis and moderated mediation) enabled us to simultaneously examine how (control strategies, emotions) and for whom (those with untapped potential) an SSC treatment facilitated two-semester performance for young adults in transition.

One limitation of the present study is that, although our model implies four separate steps (see Fig. 1), data were collected in three phases. Thus, the relationship between selective secondary control and selective primary control was based on cross-sectional data. However, an autoregressive analysis substantiated the main findings and demonstrated that this relationship remained reliable when accounting for pre-existing differences in selective primary control. A second limitation concerns our self-reported measure of HSG, which may not correspond perfectly to actual high school performance. However, previous research demonstrates this measure is strongly related to actual HSGs, $r = .84$ (Perry et al. 2005b). Further, our results (HSG-performance $r = .48$) are in line with past studies indicating that this self-report measure of HSG is a reliable and substantial predictor of post-secondary performance, including final course grades, $r = .40$–$.54$; and grade point averages, $r = .51$–$.54$ (e.g., Hamm et al. 2014; Perry et al. 2001, 2005b, 2010).

Considering that this study represents one of the first empirical examinations of control striving treatment efficacy, there are many productive avenues for future research. For instance, further research is needed to examine other influential mechanisms that may transmit control striving treatment effects, such as motivational commitment to important goals as suggested by Heckhausen et al. (2010). SSC treatments may increase the value of chosen goals (e.g., losing weight) and decrease the value of competing goals (e.g., leisure time), particularly among individuals who face challenging obstacles to goal attainment (e.g., those who are overweight).

This example points to the value of examining the influence of control striving treatments in alternate motivation domains, such as health (cf. Gitlin et al. 2006a, b). Given that research shows selective secondary control promotes psychological and physical health in young adulthood (Hamm et al. 2015), the benefits of SSC treatments may extend beyond those related to young adults' educational and career goals. Finally, considering control striving treatments can be delivered online and are therefore scalable, there may be significant practical benefits to mass administering such treatments to young adults navigating challenging life course transitions. This underscores the need for future studies to explore whether control striving treatments sustain motivation and promote goal attainment when administered en masse as part of large-scale programs designed to facilitate adaptation for young adults in transition (cf. Robbins et al. 2009).

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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