Mastery, Maladaptive Learning Behaviour, and Academic Achievement: An Intervention Approach

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Canadian Journal of Education / Revue canadienne de l'éducation 40:4 (2017)

www.cje-rce.ca

Abstract

The effects of three interventions designed to boost academic achievement among mastery-oriented students were evaluated on interest-based studying, social desirability, and perceived goal difficulty. Undergraduate students ($N = 177$) completed relevant self-report measures at the beginning and the end of the semester and were randomly assigned to one of three brief, web-based intervention conditions or a control condition. Multiple regression analyses showed the intervention conditions to consistently predict lower levels of interest-based studying, with these effects moderated by students' prior achievement and mastery-approach goals. Qualitative analyses provide insight into the motivationally relevant processes elicited by the interventions.

Keywords: education studies, educational psychology, educational research, motivation, study skills

Résumé

Les effets de trois interventions développées afin de stimuler la réussite scolaire chez les élèves orientés vers la maîtrise ont été évalués. Les étudiants de premier cycle ($N = 177$) ont complété les mesures pertinentes au début et à la fin du semestre et ont été assigné au hasard à l'une des conditions d'intervention ou un groupe control. Les résultats de régression ont démontré que les interventions ont prédite les intérêts par rapport à l'étude, modéré par l'accomplissement académique préalable et les buts de maîtrise. Les analyses qualitatives fournissent un aperçu des processus pertinents suscités par les interventions.

Mots-clés : études d'éducation, psychologie éducative, recherche educative, motivation, compétences d'étude

Introduction

"If you want truly to understand something, try to change it."
– Kurt Lewin

There is a puzzling issue that is increasingly proposed in achievement goal theory, namely that mastery-oriented students who tend to adopt a variety of adaptive behaviours do not consistently achieve high grades (see Senko, Durik, & Harackiewicz, 2008; Senko & Miles, 2008). To address this issue, three interventions were developed and implemented in an attempt to modify behaviours adopted by mastery-oriented students, and consequently promote their academic achievement. These interventions target three distinct variables that may explain the suboptimal relation between mastery-approach goals and achievement, specifically interest-based studying, perceived goal difficulty, and social desirability.

Achievement Goal Orientations

One of the most popular theories of achievement motivation over the past 25 years is achievement goal theory (Elliot & Murayama, 2008; Hulleman, Schrager, Bodmann, & Harackiewicz, 2010; Senko, Hulleman, & Harackiewicz, 2011). Achievement goals are defined as "*a future-focused cognitive representation that guides behavior to a competence-related end state that the individual is committed to either approach or avoid*" (Hulleman, Schrager, et al., 2010, p. 423, emphasis in the original). These goals have been differentiated according to two critical dimensions, the first representing approach vs. avoidance tendencies, and the second reflecting a focus on mastery and developing competence of content as contrasted with a focus on performance outcomes and demonstrating competence (Elliot, 1999; Elliot & McGregor, 2001; Pintrich, 2000). As the primary focus of the present study, mastery-approach goals are consistently found to predict greater personal and academic development in students and are characterized by interest and curiosity and reflect a desire to develop one's skills or master challenges (see Hulleman, Schrager, et al., 2010).

Mastery-approach goals are unique among achievement goal orientations in predicting a range of adaptive learning outcomes such as subject-matter interest, conceptual

change, and metacognition, as well as self-regulated learning strategies such as elaborative processing, self-monitoring, and critical thinking (Harackiewicz, Barron, Tauer, & Elliot, 2002; Muis & Franco, 2009; Pintrich, 2000; Ranellucci, Hall, & Goetz, 2015; Ranellucci et al., 2013). Although some studies report a positive link between mastery-approach goals and achievement, they are outnumbered by studies reporting a weak or null effect (see Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Hulleman, Schrager, et al., 2010; Linnenbrink-Garcia, Tyson, & Patall, 2008; Senko & Miles, 2008; Senko, Durik, & Harackiewicz, 2008).

This inconsistent relation between mastery-approach goals and achievement has led to recent lines of inquiry investigating the possibility that mastery-approach goals may be associated with maladaptive learning behaviours that account for this relationship. Specifically, mastery-approach goals have also been linked to maladaptive outcome variables such as shallow processing (for a review, see Senko et al., 2011), social desirability (Darnon, Dompnier, Delmas, Pulfrey, & Butera, 2009; Dompnier, Darnon, & Butera, 2009), and interest-based studying (i.e., focusing on personally interesting material at the expense of assigned content; Senko, Hama, & Belmonte, 2013; Senko & Miles, 2008). Although interest-based studying and social desirability can be interpreted as maladaptive when one considers their impact on the relationship between mastery-approach goals and academic achievement outcomes, these behaviours can be beneficial in specific circumstances.

Interest-based Studying

Senko and Miles (2008) found empirical support for interest-based studying as a potential mediator of the poor relation between mastery-approach goals and performance. Specifically, they identified interest-based studying as an outcome *positively* predicted by mastery-approach goals that, in turn, *negatively* predicted academic achievement. As the name suggests, interest-based studying involves deliberately choosing to focus on learning material that one is interested in, at the expense of other material essential to the course curriculum. Although it is commonly found that mastery-approach goals almost exclusively predict adaptive learning outcomes, Senko and Miles (2008) and Senko and colleagues (2013) have identified interest-based studying as a maladaptive behaviour used by mastery-oriented students. It is important to note that interest-based

studying should not be detrimental in all learning environments and contexts, but mainly in those in which student interests are not reflected in assessment methods (i.e., a "learning agenda hypothesis"; Senko et al., 2013; Senko et al., 2011). As such, given ongoing critiques concerning the persistent overemphasis on evaluation methods that do not adequately capture students' learning, interests, or academic engagement (e.g., Allen, 2005), interest-based studying can be considered a maladaptive learning behaviour in traditional classroom settings that may put mastery-oriented students at risk of lower achievement.

Social Desirability

The second variable that could explain the weak relation between mastery-approach goals and academic achievement is social desirability. Darnon, Dompnier, Delmas, and colleagues (2009) and Dompnier and colleagues (2009) conceptualize social desirability as a student's ability to meet teachers' motivation and aims and thus to be appreciated by their teachers for their efforts and improvement. Recent studies suggest that mastery-approach goals may be associated with higher levels on social desirability indices (e.g., Day, Radosevich, & Chasteen, 2003; Hulleman & Senko, 2010) with mastery-oriented students being more likely to adopt social goals that involve seeking approval from their teachers concerning their learning progress (Anderman & Anderman, 1999). More specifically, Darnon, Dompnier, Delmas, and colleagues (2009) have explored the link between social desirability and mastery-approach goals and found mastery-oriented learners to be motivated not only to develop their competencies, but also to demonstrate this improvement to their teachers. Research by Dompnier and colleagues (2009) further revealed an interaction effect, showing students with high levels of mastery-approach goals tend to obtain better grades, but only when social desirability levels were low. Darnon, Dompnier, Delmas, and colleagues (2009) and Dompnier and colleagues (2009) conceptualize social desirability as a student's ability to meet teachers' motivation and aims, and thus to be appreciated by their teachers for their efforts and improvement.

Perceived Goal Difficulty

A third possible reason why mastery-approach goals tend to weakly predict academic achievement relates to the underlying theoretical conceptualization of mastery-approach goals. When initially proposed, it was hypothesized that even if mastery-approach

oriented learners "fail to reach the standard they have set, they may still be pleased with their increased skill or knowledge" (Dweck & Elliott, 1983, p. 656). Accordingly, researchers have proposed the goal difficulty mechanism as an explanation for the relation between achievement goals and academic achievement (e.g., Senko et al., 2011). In this regard, Senko and colleagues (2011) draw on theories proposing the necessity of effort-arousal mechanisms for performance, such as goal-setting theory (Locke & Latham, 2002) and motivational intensity theory (Brehm & Self, 1989), to explain why mastery-approach goals weakly relate to academic achievement outcomes. Specifically, Senko and colleagues (2011) propose that mastery-approach goals often do not induce sufficient pressure to motivate students to attain high grades, as a student who adopts the goals of learning, competence, and striving for (but not necessarily attaining) their potential should perceive these goals as more attainable as compared to externally imposed goals (e.g., criterion referenced grades). It is important to acknowledge that although Senko and colleagues (2011) frame the goal difficulty explanation as an effort-arousal mechanism, mastery-approach goals are associated with numerous adaptive, and high arousal outcomes, including enjoyment (Pekrun, Elliot, & Maier, 2009), intrinsic motivation (Elliot & Murayama, 2008), and persistence (Sideridis & Kaplan, 2011). Therefore, the explanation for why mastery-approach goals do not consistently predict academic achievement outcomes might be more clearly understood as a result of mastery-approach goals not leading to a high pressure to perform, and therefore being low stress goals. Although the goal difficulty explanation may be counterintuitive, and does not account for high grades being an unlikely outcome for mastery-oriented students, it has received some empirical support. For instance, Senko and colleagues (Senko & Harackiewicz, 2005; Senko & Hulleman, 2013) found mastery-approach goals to be perceived as being easier to attain than performance-approach goals in a classroom-based study with college students, and in a laboratory-based study found manipulated increases in perceived goal difficulty to predict greater performance in mastery-approach oriented participants. In line with this prior work, goal difficulty is conceptualized as a mediator of the relation between mastery-approach goals and academic achievement, namely students that endorse stronger mastery-approach goals are also expected to report low task goal difficulty, which in turn negatively predicts academic achievement.

The Present Study

In an effort to expand upon limited existing research evaluating the potential utility of motivational programs to address the weak link between mastery-approach goals and achievement, the present research explored the potential benefits of informational, web-based interventions targeting each of the aforementioned potential mediators (i.e., interest-based studying and perceived goal difficulty) and moderator (i.e., social desirability) of this relationship. The present study evaluates the potential for intervention programs specifically targeting social desirability, interest-based studying, and perceived goal difficulty to improve performance outcomes in mastery-oriented students. In contrast to conventional motivational interventions, such as attribution retraining (e.g., Perry, Stupnisky, Hall, Chipperfield, & Weiner, 2010) or utility-value interventions (e.g., Hulleman & Harackiewicz, 2009), which target at-risk students (i.e., low perceived competence, low perceived control, or and low utility-value), the interventions in the present study target mastery-oriented students that espouse largely adaptive learning–related beliefs and behaviours (e.g., Elliot & McGregor, 2001; Hulleman et al., 2010; Senko et al., 2011). As such, since the target outcomes of the present interventions are related to mastery-approach goals, it is hypothesized that these interventions will be particularly effective for students that report higher levels of mastery-approach goals.

The present study builds on existing research in the achievement goal domain in incorporating laboratory-based protocols (Darnon et al., 2009; Senko & Harackiewicz, 2005) into authentic classroom achievement settings to evaluate the potentially maladaptive mediators and moderators of the mastery-achievement relationship, and experimentally evaluating these variables as identified in correlational research by Senko and colleagues (Senko & Miles, 2008; Senko et al., 2013). Further, this study expands upon research on motivational programs promoting engagement in struggling students based on achievement goal theory (e.g., Linnenbrink, 2005; Muis, Ranellucci, Franco, & Crippen, 2013), attribution theory (for reviews, see Forsterling, 1985; Haynes, Perry, Stupnisky, & Daniels, 2009), and expectancy-value theory (e.g., Durik & Harackiewicz, 2007; Godes, Hulleman, & Harackiewicz, 2007; Hulleman & Harackiewicz, 2009) by specifically addressing possibly maladaptive characteristics of mastery-oriented students. Although substantial theoretical attention and empirical work has focused on how mastery-approach goals are especially adaptive, little attention has been paid to some of the

limitations of this achievement goal (see Senko et al., 2013). As such, the present longitudinal (pre-post) study allows for not only an experimental evaluation of the salience of potentially maladaptive study behaviours for mastery-oriented students, but also the benefits of targeted programs for improving the link between mastery-approach goals and achievement. Therefore, the primary purpose of this study is to evaluate the effectiveness of three different interventions, each targeting a different variable that is hypothesized to relate to the relation between mastery-approach goals and academic achievement.

Three hypotheses are proposed. First, it was anticipated that participants with higher levels of mastery-approach goals and lower prior academic achievement would report lower levels of social desirability and higher final grades in the social desirability intervention condition relative to the control group. Second, it was hypothesized that participants with higher levels of mastery-approach goals and lower prior academic achievement would report higher levels of goal difficulty and higher final grades in the goal difficulty intervention condition compared to the control group. Finally, it was hypothesized that participants with higher levels of mastery-approach goals and lower prior academic achievement would report lower levels of interest-based studying and higher final grades in the interest intervention condition relative to the control group. Testing each of these hypotheses involves examining main effects between each intervention and levels of mastery-approach and prior academic achievement, two-way interactions between these variables, as well as possible three-way interactions. Specifically, three-way interaction effects were anticipated, with students having lower prior academic achievement and high levels of mastery-approach goals expected to report more optimal levels of the specific learning behaviour addressed in the intervention, and higher achievement levels in the intervention condition, relative to controls. In other words, mastery-oriented students who were already performing poorly were expected to benefit from the intervention content.[1]

In addition to evaluating the quantitative effect of each of these interventions on specific outcomes (i.e., interest-based studying, social desirability, perceived goal

1 Although empirical work has identified interest-based studying as a mediator of the relationship between mastery-approach goals and academic achievement (see Senko & Miles, 2008; Senko et al., 2013), the present study did not attempt to reduce interest-based studying for all students as it may nonetheless be adaptive in certain learning contexts and for highly regulated students. As such, the interest-based intervention targeted this behaviour specifically among mastery-oriented students by specifying in the intervention text that interest-based studying among mastery-oriented students may be maladaptive as opposed to all students.

difficulty, and academic achievement), this study also uses qualitative methods to investigate the processes taking place during the writing task portion of the interventions. In particular, these additional analyses contribute in at least three ways. First, analyzing the content of what students wrote provides a fidelity test of the interventions, and makes it possible to determine the extent to which students followed the instructions. Second, these analyses provide insight into the motivationally relevant processes that students were reflecting on while participating in the written portion of the interventions. For instance, are students in the intervention groups discussing value, effort, or emotions in their writing? Third, qualitatively coding what students write about will provide a richer interpretation of the results of the quantitative analyses.

Methods

Participants and Procedure

One hundred and seventy-seven undergraduate students were recruited from four first-level educational psychology courses at a large Canadian university to participate in a two-part study, consisting of web-based questionnaires and reading materials. The courses were selected based on convenience and all procedures were approved by the university's institutional review board (IRB). The sample was composed of 141 females and 36 males. The mean age of participants was 22.16 years (SD = 3.17), the mean number of semesters completed was 4.16 (SD = 2.40), and the mean self-reported prior grade point average (GPA) was 3.51 (SD = .44) on a 4-point scale. Pre-test questionnaires assessing students' goal orientations, interest-based studying, social desirability, and goal difficulty were administered during the first four weeks of classes, with the identical post-test questionnaires administered once again at the end of the semester. To reduce response acquiescence of the mastery-approach items and the social desirability items, the mastery-approach scale was assessed first, followed by the other study measures, with the social desirability scale completed last. After completing the pre-test questionnaires, participants were randomly assigned to one of three intervention conditions addressing interest-based studying (n = 42), social desirability (n = 52), and goal difficulty (n = 41), or a control group (n = 42). Participants were subsequently presented with the corresponding intervention text, and

provided a typed response to the intervention material at least 10 sentences in length. Course grades were obtained from course professors for consenting students following completion of the study.

Study Measures

Means and standard deviations for the study measures in the pre- and post-test assessments in each experimental condition are provided in Table 1.

Table 1. Descriptive statistics

	Time 1 *M (SD)*	Time 2 *M (SD)*
Total sample		
MAP	4.20 (.79)	4.17 (.75)
Interest-based studying	3.17 (.71)	3.2 (.73)
Social desirability	4.30 (.69)	4.44 (.69)
Perceived goal difficulty	3.30 (.52)	3.17 (.57)
Self-reported GPA	3.51 (.44)	-
Final grade	-	85.47 (8.73)
Control group		
MAP	4.16 (.96)	4.26 (.79)
Interest-based studying	3.09 (.70)	3.22 (.65)
Social desirability	4.49 (.60)	4.50 (.62)
Perceived goal difficulty	3.28 (.58)	3.26 (.76)
Self-reported GPA	3.59 (.37)	-
Final grade	-	85.66 (8.33)
Interest-based studying intervention group		
MAP	4.22 (.54)	3.96 (.73)
Interest-based studying	3.30 (.69)	3.34 (.78)
Social desirability	4.23 (.78)	4.26 (.73)
Perceived goal difficulty	3.30 (.51)	3.22 (.40)
Self-reported GPA	3.58 (.41)	-
Final grade	-	86.31 (8.52)
Social desirability intervention group		
MAP	4.34 (.73)	4.22 (.75)
Interest-based studying	3.15 (.73)	3.12 (.77)

	Time 1 *M (SD)*	Time 2 *M (SD)*
Social desirability	4.51 (.57)	4.55 (.72)
Perceived goal difficulty	3.40 (.49)	3.21 (.42)
Self-reported GPA	3.46 (.43)	-
Final grade	-	84.42 (9.47)
Perceived goal difficulty intervention group		
MAP	4.05 (.86)	4.22 (.71)
Interest-based studying	3.13 (.71)	3.16 (.72)
Social desirability	4.30 (.82)	4.43 (.67)
Perceived goal difficulty	3.12 (.50)	2.98 (.64)
Self-reported GPA	3.42 (.55)	-
Final grade	-	85.71 (8.64)

Note. MAP = Mastery-approach goals; GPA = grade point average. GPA is on a 4.0 scale and the final grade is a percentage.

Achievement goals. The mastery-approach subscale of the Achievement Goal Questionnaire-Revised (AGQ-R; Elliot & Murayama, 2008) was used to measure students' personal achievement goals concerning learning and competence with respect to their educational psychology course. Responses to three survey items were based on a 5-point Likert scale ranging from one (*strongly disagree*) to five (*strongly agree*), with item responses summed and averaged to form a composite variable. A sample mastery-approach goal item is "My aim is to completely master the material presented in this class" (Time 1/2 αs = .86/.87).

Interest-based studying. Interest-based studying was measured using a five-item scale initially developed by Senko and Miles (2008). This 5-point Likert scale consists of items with anchors ranging from one (*strongly agree*) to five (*strongly disagree*), with item responses summed and averaged to form a composite variable. A sample interest-based studying item is "I often spend more time reading things I find interesting than what is required" (Time 1/2 αs = .63/.73).

Social desirability. A modified version of the mastery-approach goal orientation measure (AGQ-R; Elliot & Murayama, 2008) evaluated the extent to which participants

perceived mastery-approach goals as socially desirable by instructors (cf. a similarly modified version of the earlier AGQ by Dompnier et al., 2009). Prior to completing the regular scale items, participants were presented with a modified preamble asking them to "indicate your level of agreement with each of the following statements, with a view to presenting yourself as someone who is likely to be appreciated by your teachers" (Dompnier et al., 2009, p. 940). Participants subsequently completed the three AGQ-R items on a 5-point Likert scale ranging from one (*strongly disagree*) to five (*strongly agree*), with item responses once again summed and averaged to create a composite variable (Time 1/2 αs = .90/.91).[2]

Goal difficulty. Participants were asked to answer two Likert scale questions corresponding to their responses to the following open-ended question: "What are your goals for this education course?" The goal difficulty items included the following: (1) "The recommended goal will be difficult to meet" and (2) "I am confident that I will meet the recommended goal" (Time 1/2 *rs* = .36/.33). Therefore, perceived goal difficulty was assessed in relation to the goals listed with two items initially formulated by Senko and Harackiewicz (2005), who used this measure in a laboratory study where they manipulated goals. Directly after the open-ended question, participants responded to the two questions on a 5-point Likert scale ranging from one (*strongly disagree*) to five (*strongly agree*). The second item was reversed such that a higher score indicated more goal difficulty and then item responses were summed and averaged to form a composite variable.

Grades. Prior GPA scores were collected with a self-report item asking students to report their average GPA from the previous semester. Final course grades were collected directly from course instructors for consenting students and consisted of a composite of grades on class exams, assignments, presentations, and group projects, as well as class participation.

2 Although the items used to assess social desirability are identical to those used to assess mastery goals, participants were not requested to report their personal mastery goals. Instead, the instructions required participants to report their perceptions of self-presentation with respect to their course instructors. Consequently, this modification allowed this measure to provide an estimation of participants' socially desirable behaviour with respect to their instructors.

Intervention Content

In line with the recently demonstrated effectiveness of informational motivational interventions based on expectancy-value theory (i.e., utility-value interventions; Hulleman, Godes, Hendricks, & Harackiewicz, 2010; Hulleman & Harackiewicz, 2009; Shin, Ranellucci, & Roseth, 2017) and attribution theory (i.e., attributional retraining; Hall, Perry, Chipperfield, Clifton, & Haynes, 2006), experimental protocols similar to those employed in these research literatures were adapted for the present study. More specifically, three versions of a web-based intervention were developed and contrasted with a control condition, each targeting a specific variable hypothesized to explain the weak relationship between mastery-approach goals and academic achievement (interest-based studying, social desirability, goal difficulty). Each experimental condition was administered in two phases: the first phase presented participants with a brief reading, and the second required the completion of a short writing task.

In the intervention text, the drawbacks of a specific behaviour (e.g., interest-based studying) were explicitly addressed, no method for limiting this behaviour, or reasons why one would engage in this behaviour, were described. The rationale for this self-generated approach was (1) to align with the utility-value interventions, which ask students to self-generate reasons why learning a particular topic can be personally useful (e.g., Hulleman et al., 2010), and (2) to promote elaborative thinking and deeper processing, which was hypothesized to increase the effectiveness of the interventions (see Hall, Hladkyj, Perry, & Ruthig, 2004; Phan, 2009). A sample phrase for the interest-based studying intervention was "this behaviour leads to some adaptive outcomes, such as going beyond the course content…however this behaviour also has the potential of hindering a student's academic achievement." A sample phrase for the goal difficulty intervention was "underestimating goal difficulty in academic settings…can lead students to invest less effort than is required." A sample social desirability phrase was "a student who is motivated by a social goal of impressing their teacher or parents may not attain their highest grade potential in the course."

In the control condition, participants were presented with a brief reading concerning the general importance of motivation in educational settings. In contrast to the intervention texts that drew attention to specific drawbacks of particular behaviours, no specific explanation for why particular motivational constructs were related to learning

or achievement outcomes were discussed in the control condition. Consistent with writing-based methods commonly employed in attribution retraining and value-based intervention research (e.g., Hall et al., 2006; Hulleman, Godes, et al., 2010), the second phase of the intervention required participants to provide a written response to the motivational information presented. More specifically, participants in the three intervention conditions were instructed to write a brief letter offering advice to a friend who was having difficulty obtaining high grades due to engaging in the behaviour specifically addressed in the informational phase of the intervention. Alternatively, control group participants were requested to write a letter that more generally addressed the potential role of motivation in poor performance.

Qualitative Analyses

A deductive and inductive thematic analysis (Creswell, Hanson, Plano, & Morales, 2007; Hatch, 2002) was used to identify the primary themes in the written portions of the interventions and the control manipulations. A deductive approach is a top-down procedure that uses existing theory and research to identify relevant constructs in the data, whereas an inductive approach is a bottom-up procedure that involves using the data collected to identify relevant constructs worth measuring. The deductive codes were generated according to theoretically relevant constructs, including *mastery-approach goals*,[3] *interest-based studying*, *social desirability*, and *perceived goal difficulty*. These constructs were defined according to prior theoretical and empirical work that were guiding the design of the present study (i.e., Crowne & Marlowe, 1960; Darnon et al., 2009; Hulleman et al., 2010; Senko et al., 2011; Senko & Miles, 2008). Additional deductive codes were generated based on the intended purpose of the interventions, namely for participants to provide *advice*, related to *academic achievement*, which potentially included reflecting on *personal experience*. The rationale for coding evidence of personal experiences or self-reference was to assess the degree to which students may have internalized the message. Two research assistants, blind to the conditions, independently coded a random sample of 10 texts per condition ($N = 40$), representing approximately 22.6% of

3 Mastery-avoidance, performance-approach, and performance-avoidance goals were included in the original deductive codes; however, since these goals were infrequently coded (from 0 to 5%), we do not report these results.

the total written data collected. Following this initial coding, research assistants met to clarify the descriptions of the deductive codes, without referring to the coded data, and to recommend relevant processes not captured by the first version of the coding manual that emerged from the data. Specifically, additional inductive codes included motivation, value, effort, and emotions. Value was coded based on definitions of attainment value and utility value described in the literature (see Wigfield & Eccles, 2000), whereas motivation, effort, and emotions were more generally coded according to colloquial uses. Descriptions and in-text examples of each code are displayed in the qualitative coding manual (see Appendix). The texts were then independently coded according to the qualitative coding manual. Texts were coded as "1" when an example of the given construct was present, and coded as a "0" when no evidence of a construct was identified. The inter-rater reliability was assessed by comparing the codes of the two blind coders, which ranged from Kappas of .60 to .95.

Results

Preliminary Analyses

Normality was verified with all variables to ensure they fell within an acceptable range for skewness (-1.46 to .73) and kurtosis (-.38 to 3.38). No outliers were detected, and no missing data points were identified. Forty-three participants did not participate in the second phase of the study (24% attrition), with one-way ANOVAs indicating no differences between completers and non-completers on pre-test measures of mastery-approach goals, interest-based studying, social desirability, goal difficulty, and self-reported grades. Furthermore, an additional one-way ANOVA indicated that these non-completers were equally distributed across conditions. As such, students with missing data were removed from subsequent analyses. Descriptive statistics and correlations are displayed in Tables 1 and 2.

Table 2. Total sample correlation matrix

	1	2	3	4	5	6
1. MAP	-	-.05	.41**	.16*	.09	.18*
2. IBS	.08	-	-.17*	.16*	-.06	-.20*
3. SD	.65**	.16	-	.23**	.12	.17*
4. GD	.02	.20*	.10	-	.04	.02
5. SR-GPA	.11	-.00	.08	.04	-	.16*
6. Grade	.15	.02	.19*	-.09	.16*	-

Note. Time 1 above diagonal, Time 2 below the diagonal. MAP = mastery-approach goals, IBS = interest-based studying, SD = social desirability, GD = perceived goal difficulty, SR-GPA = self-reported GPA, grade = final course grade. $^{**}p \leq .01$, $^{*}p \leq .05$.

An additional preliminary analysis was run to verify if the interventions affected mastery-approach goals. Specifically, a hierarchical regression was performed to assess the effects of the three interventions on Time 2 mastery-approach goals. Mastery-approach Time 1 was included in Step 1, and dummy-coded variables indicating each type of intervention (0 = control, 1 = intervention) were included in Step 2. Results indicated that students in the interest-based studying condition reported a significant reduction in mastery-approach goals from Time 1 to Time 2, $\beta = -.19$, $p = .049$.

Rationale for Quantitative Analysis

As outlined in Table 3, four hierarchical regression analyses were performed in which the effects of each intervention were evaluated on interest-based studying (IBS), social desirability (SD), goal difficulty (GD), and course grades. Variables included in Step 1 consisted of Time 1 mastery-approach goals, self-reported prior GPA, a Time 1 (baseline) measure of the dependent variable, and dummy-coded variables indicating each type of intervention assessed (0 = control, 1 = intervention). In Step 2, all two-way interactions between Time 1 mastery-approach goals, prior self-reported GPA, and each intervention were included with a three-way interactions between these variables included in Step 3 (independent variables were mean-centred prior to analysis). The purpose of these analyses was to verify if the interventions were affecting the targeted outcome (e.g., the interest-based intervention is hypothesized to reduce interest-based studying, but not social desirability).

Table 3. Effects of interest-based studying intervention on interest-based studying, social desirability, perceived goal difficulty, and course grade

	Time 2 scores							
Predictor	IBS	R^2	SD	R^2	GD	R^2	Grade	R^2
Step 1								
MAP	.35†		.27		-.15		.31	
SR-GPA	.48*		.06		-.26		.09	
Baseline	.43**		.20*		.23**		-	
IBS-I	.09		-.12		-.04		-.02	
SD-I	.00		.00		-.08		-.07	
GD-I	-.02	.23**	-.00	.16**	-.24*	.11*	-.02	.06†
Step 2								
MAP x SR-GPA	-.35		-.19		.18		-.22	
MAP x IBS-I	-.20†		.04		.00		-.08	
MAP x SD-I	-.17		.03		.08		.02	
MAP x GD-I	-.21		-.11		.20		.01	
SR-GPA x IBS-I	-.31*		.02		.05		.15	
SR-GPA x SD-I	-.24*		-.01		.19		.05	
SR-GPA x GD-I	-.20	.29	.07	.21	.25	.16	-.02	.10
Step 3								
MAP x SR-GPA x IBS-I	-.02		.07		.02		-.07	
MAP x SR-GPA x SD-I	-.05		-.18		-.10		.12	
MAP x SR-GPA x GD-I	.46*	.39**	.12	.25†	.09	.17	.32	.14

Note. MAP = Time 1 mastery-approach goals, SR-GPA = self-reported GPA, Baseline = Time 1 baseline of the outcome variable, IBS-I = interest-based studying intervention, SD-I = social desirability intervention, and GD-I = goal difficulty intervention (0 = control, 1 = intervention). "x" indicates an interaction term between variables. The baseline for the grade outcome is SR-GPA. All independent variables are mean centred. **$p \leq .01$, *$p \leq .05$, †$p \leq .10$.

Academic achievement. The regression that tested the effects of the interventions on final course grade suggested that the three interventions did not result in a significant change in grades, with no interaction effects reaching statistical significance. Since the interventions did not impact grades, tests of mediation were not warranted.

Interest-based studying. Regression findings for interest-based studying yielded four significant findings. First, the interest-based studying intervention revealed a significant two-way interaction between the interest-based studying intervention and prior GPA on interest-based studying, β = -.31, p = .012. As shown in Figure 1, the intervention had an opposite effect for low- vs. high-achieving students, with low-achieving students reporting less interest-based studying in the intervention group (M = 2.68) relative to controls (M = 3.20), and high-achieving students reporting higher interest-based studying in the intervention condition (M = 3.57) compared to controls (M = 3.29). As shown in Figure 1, analyses indicated that the simple slopes for the interaction between the interest-based studying intervention and mastery was marginally significant for interest-based studying, β = -.20, p = .063. Figure 2 shows an effect on interest-based studying for students with low mastery-approach goals, specifically students with low mastery-approach goals reported lower interest-based studying in the interest-based studying intervention than in the control group. Simple slopes analyses indicated that slopes are significantly different from zero for the intervention group (β = -.36, p = .04), however, no significant difference was found for the control group (β = .14, p = .36).

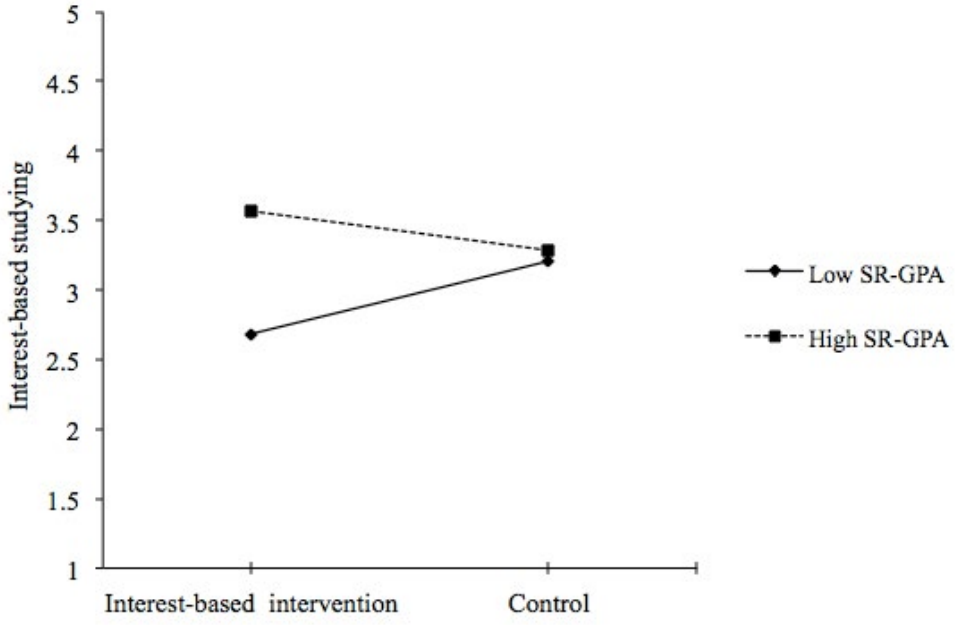

Figure 1. Interest-based studying intervention by self-reported GPA interaction effect on interest-based studying. SR-GPA = self-reported GPA, high and low based on +/- 1 standard deviation

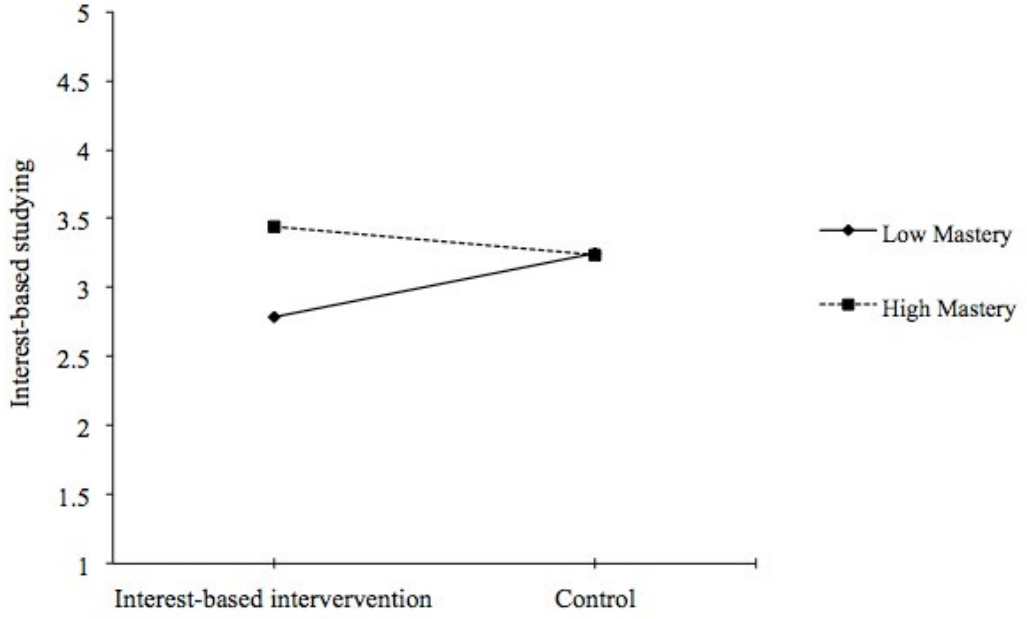

Figure 2. Interest-based intervention by mastery-approach interaction effect on interest-based studying. High and low based on +/- 1 standard deviation

Regression findings for the social desirability intervention revealed a significant interaction between the social desirability intervention and prior GPA on interest-based studying, β = -.24, p = .051. As displayed in Figure 3, whereas interest-based studying levels were lower for poor-performing students in the intervention condition (M = 2.74) relative to controls (M = 3.06), high-achieving students reported higher levels of interest-based studying in the intervention condition (M = 3.56) relative to controls (M = 3.25). Simple slopes analyses indicated that slopes are a marginally significant difference from zero for the intervention group (β = -.78, p = .056) but not for the control group (β =.003, p = .985).

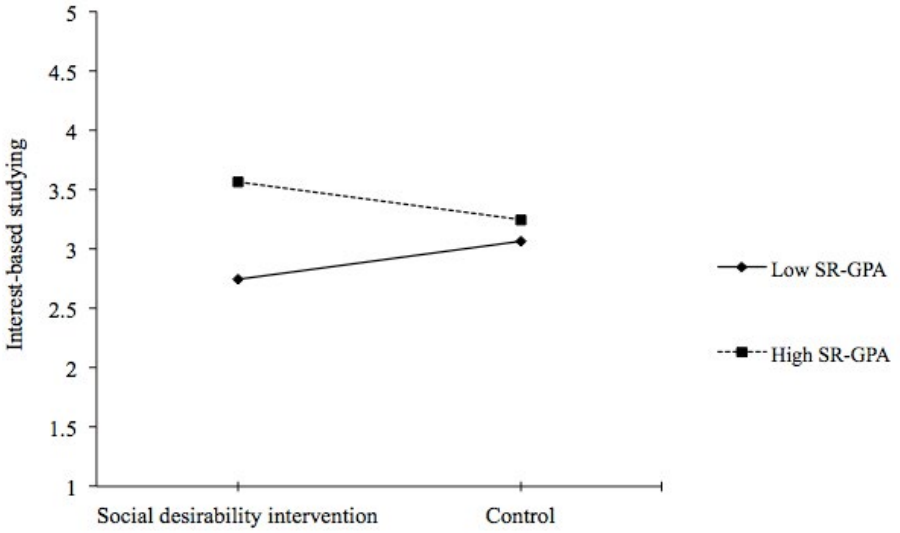

Figure 3. Social desirability intervention by self-reported GPA interaction effect on interest-based studying. SR-GPA = self-reported GPA, high and low based on +/- 1 standard deviation

Finally, a significant three-way interaction between the goal difficulty intervention, mastery-approach goals, and prior GPA was found on interest-based studying, β = .46, p = .018. As shown in Figure 4, the effects of the goal difficulty intervention on interest-based studying were most evident for low-achieving students, and further, were opposite for low-achievers reporting low- vs. high-mastery levels. Consistent with the pattern observed in marginally significant interaction in the IBS-I analysis, the goal difficulty intervention led to lower levels for low-mastery students who also reported low prior achievement (M = 2.11) in comparison to their counterpart in the control group (M = 2.92). Slope difference tests indicated that slope 1 (t(81) = -2.045, p = .043), slope 2 (t(81) = -2.706, p = .008), and slope 3 (t(81) = -2.216, p = .029) are significantly different from slope 4.

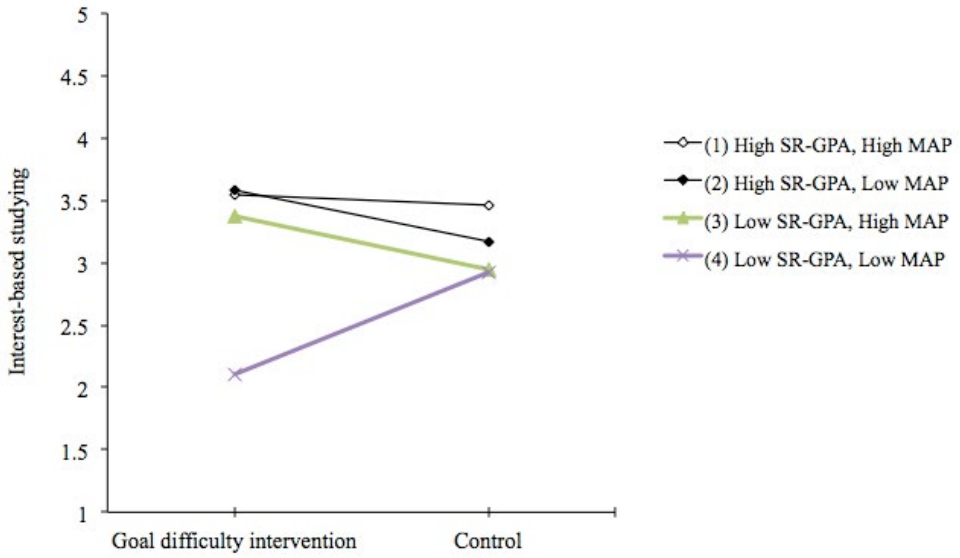

Figure 4. Three-way interaction of the goal difficulty intervention, self-reported GPA, and mastery-approach goals on levels of interest-based studying

Social desirability. The regression that tested the effects of the interventions on social desirability indicated that the three interventions did not result in a significant change in social desirability, with no interaction effects reaching statistical significance.

Goal difficulty. Regression findings for the goal difficulty outcome identified a lower-order effect of the goal difficulty intervention on perceived goal difficulty, $\beta = -.24$, $p = .027$, showing that students who received the goal difficulty intervention reported a significant decrease in their perceived goal difficulty in comparison to the control group.

Qualitative Results

Qualitative analyses provided a manipulation check and revealed several motivationally relevant themes across the different conditions (see Table 4). First, in terms of the fidelity of the conditions, the qualitative coding suggested that the manipulations increased reflection on the target outcomes. For instance, 60% of the interest-based studying intervention texts included reference to interest-based studying, 100% of the sample of

the social desirability intervention texts discussed social desirability, and 40% of the perceived goal difficulty intervention texts referred to perceived goal difficulty. Furthermore, with the exception of 10% of interest-based studying intervention texts referring to perceived goal difficulty, there was no evidence of contamination between conditions (i.e., the interventions targeted the designated outcome, but did not increase reflection on the targeted outcomes of the other interventions). However, 20% of students in the control group wrote about perceived goal difficulty and 10% wrote about social desirability, suggesting that the control group may have unintentionally promoted reflection on some of the targeted outcomes.

Table 4. Inter-rater reliability and percentage in the written reflections by condition

Code	Kappa	Percentage by condition			
		Interest-based studying	Social desirability	Perceived goal difficulty	Control
Interest-based studying	.95	60	0	0	0
Social desirability	.91	0	100	0	10
Perceived goal difficulty	.84	10	0	40	20
Self-reference	.78	20	40	30	20
Provides advice	-[1]	100	100	100	100
Refers to achievement	-[1]	100	100	100	100
Mastery-approach	.68	0	50	10	40
Motivation	.83	30	40	30	20
Value	.60	20	60	10	20
Effort	.63	0	40	50	30
Emotions	.70	10	70	0	50

Note. Percentages represent the percentage of texts in a given condition where a code was identified.

[1] Kappa was not computed as 100% of the texts coded contained evidence of these codes.

The qualitative coding also provided evidence that students followed the instructions by providing advice to their peers and focusing on academic achievement. Notably, 100% of the texts contained evidence of students giving advice to a peer about their academic achievement, including for the control group. In addition to examining the fidelity of students' writing according to the explicit instructions, the degree to which students reported personal experiences was also coded. Results indicated that reference to personal experiences were identified relatively infrequently, specifically, 20% in the interest-based studying condition, 40% in the social desirability condition, 30% in the perceived goal

difficulty condition, and 20% in the control condition. Furthermore, reference to mastery-approach goals was especially pronounced in the social desirability condition (50%) and the control condition (40%), in contrast to the interest-based studying condition (0%) and the perceived goal difficulty condition (10%).

Results from the inductive qualitative analyses focused on four motivationally relevant constructs that emerged from the data. First, the general theme of motivation was observed at a similar frequency across all conditions (20% to 40%). Second, value was identified in 60% of the social desirability intervention texts, whereas it was only coded in 10–20% of the other conditions. This suggested that in addition to increasing reflection on social desirability in the social desirability condition, this manipulation may have also increased students' attention to the value of learning or getting higher grades. The third motivationally relevant construct that emerged from the data was effort. Results indicated a similar frequency of effort in the texts associated with the social desirability intervention (40%), the perceived goal difficulty intervention (50%), and the control condition (30%). In contrast, no instances of reference to effort were identified in the interest-based studying condition. A final construct assessed was the presence of emotions. Evidence of emotions were recorded in the social desirability condition (70%) and for the control group (50%), whereas few emotions were identified in the interest-based studying condition (10%) or the perceived goal difficulty condition (0%).

Discussion

Consistent with prior studies, the relationship between mastery-approach goals and academic achievement was found to be positive and generally weak as evidenced by the correlations at Time 1 and Time 2 with course grade (see Table 2; cf. Hulleman, Schrager, et al., 2010; Linnenbrink-Garcia et al., 2008). With respect to the hypothesized intervention effects, however, the results yielded four main sets of findings.

First, although each intervention predicted changes in levels of interest-based studying or perceived goal difficulty relative to controls, these effects were generally not observed for mastery-oriented students as was expected. Specifically, two interventions were found to benefit students reporting poor academic performance, as evidenced by significant two-way interactions between the interest-based studying intervention and the

social desirability intervention formats and prior GPA (see Figures 1 and 3). Although not anticipated, these interactions are consistent with recent studies and encouraging in showing brief, web-based motivational programs to assist students who are struggling academically (Morisano, Hirsh, Peterson, Pihl, & Shore, 2010; Muis et al., 2013), and more specifically, showing programs that highlight the potential drawbacks of seemingly beneficial learning behaviours.

A second interesting set of results from the present study showed each intervention program to predict significantly better levels of one learning behaviour in particular, namely *interest-based studying*. Whereas each intervention format was expected to predict lower levels of the learning behaviour explicitly addressed in the intervention materials (e.g., social desirability intervention predicting lower levels of social desirability vs. perceived goal difficulty), each intervention predicted lower levels of interest-based studying for unsuccessful students. These findings suggest that informing students more generally of the potential achievement drawbacks (that have recently been explored in relation to mastery goals) should result in reliable improvements in interest-based studying behaviours, regardless of the specific variable proposed to account for this relationship. One question that these results stimulate is why was interest-based studying the primary variable that changed in relation to these interventions?

A possible explanation for this unique effect on interest-based studying relates to the potential hierarchical structure of the target behaviours. Prior research suggests that variables can be organized hierarchically based on stability over time. For instance, generalized anxiety is more stable than test anxiety (Zeidner, 1998), general self-concept is more stable than academic self-concept (Marsh & Shavelson, 1985), and context-specific experiences of enjoyment (e.g., enjoyment in school) are more stable than situation-specific experiences of enjoyment (e.g., enjoyment during exams; Goetz, Hall, Frenzel, & Pekrun, 2006). Therefore, it is possible that interest-based studying, social desirability, and perceived goal difficulty are situated at different hierarchical levels of stability, and are therefore not equally susceptible to change over time, or as a result of a brief intervention. As such, prior to designing new motivational interventions, future researchers need to carefully consider the stability of the targeted behaviour, and the expected effect size of the intervention.

The third set of findings concerning the intervention programs pertain to the notable lack of treatment effects on academic achievement. Despite the programs proving

consistently effective in predicting lower interest-based studying for unsuccessful students, neither main nor interaction effects for the interventions were found on course grades. This lack of results does not support our study hypotheses concerning achievement effects, did not make it possible to investigate potential mediating effects, and is also not consistent with the negative relationship between academic achievement and interest-based studying observed in this study (Time 2 correlation) and in prior research (i.e., final course grade: Senko & Miles, 2008; exam performance: Senko et al., 2013). One possible explanation for these findings is that academic achievement was assessed primarily via summative assessment. Future research should investigate if these interventions are more effective with more formative types of assessment, which might align better with the goals of mastery-oriented students.

Finally, whereas three-way interactions were proposed in which the interventions were to optimally assist unsuccessful, mastery-oriented students, the single three-way interaction effect observed in this study did not produce the anticipated pattern of results. More specifically, the intervention program encouraging students to consider the potential drawbacks associated with underestimating goal difficulty (e.g., doing well on an upcoming test) did result in lower maladaptive learning behaviours (interest-based studying), albeit only for students reporting low levels of mastery-approach goals. The qualitative analyses help explain these results. In particular, only 10% of the students in the perceived goal difficulty condition referred to mastery-approach goals in their short texts, which suggests that the association between this condition and mastery-approach goals may have been less apparent than originally intended. Although this specific pattern was not observed for other outcomes or interventions, it does suggest that students who are not mastery-oriented can benefit by participating in programs that discourage study behaviours that, while enjoyable, can lead to achievement deficits. Thus, although some researchers have recommended that "it is time to move on to other constructs that can better guide our understanding of achievement" (Huang, 2012, p. 68), we believe the inconsistency of our findings with the extant literature on high-mastery students, and the benefits of learning strategy programs for unsuccessful and low-mastery students, warrant further investigation. Specifically, these findings underscore the importance of future research to further explore increasingly mixed results concerning (1) the relationship between mastery-approach goals and academic achievement, (2) the potential benefits and complexity of designing and implementing brief social-psychological interventions (see

Walton, 2014; Yeager & Walton, 2011), and (3) the significance of investigating specific mediating or moderating variables (e.g., interest-based studying) and moderating factors (e.g., prior achievement).

In sum, the present study represents a preliminary experimental investigation of the potential contributors to the mediocre relationship between mastery-approach goals and objective achievement outcomes, as well as the potential benefits of web-based programs in which these variables are specifically addressed.

Appendix

Qualitative Coding Manual

Codes	Description	In-text example
Interest-based studying	Deliberately choosing to focus on learning material that one is interested in, at the expense of other material important to the course curriculum (see Senko & Miles, 2008).	"refrain his/her mind from wandering too much or being distracted by a section that is particularly interesting"; "studying this way also allows for some accommodation in case he/she does become distracted by more interesting material"; "I had a lot of trouble seeing the overall content of the course and would often only pursue topics that were of interest to me"
Social desirability	Tendency to behave in a culturally or socially acceptable manner. Student's ability to meet teachers' motivation and aims or be appreciated by their teachers (see Crowne & Marlowe, 1960; Darnon et al., 2009).	"I feel you are too concerned with what others expect and want of you"; "impressing someone else is not good enough"; "You'll still have to work hard, but it'll be for you, not for someone else"
Perceived goal difficulty	Perceiving goals or tasks as difficult to attain or high pressure to perform (see Senko et al., 2011).	"Nothing is easy in life; we all have to work to achieve our goals"; "If you feel the class is an easy no work class (aka an easy pass), then the efforts you put in are going to match that thought process"; "not underestimate the class requirements or workload"
Self-reference	Reference is made to ones' self.	"I know this, because I used to do the same"; "In my personal experience"; "Now when something related to school goes well or not so well I understand that it is because of me"
Provides advice	The author provides advice to a peer.	"perhaps they should"; "I would tell him/her to"; "I would advise my friend to"
Refers to achievement	Reference is made to academic achievement.	"in order to do well on the online quizzes"; "it becomes easier for you to explain yourself in exams"; "In order to do better on the next test"
Mastery-approach	The goal of developing competence or to master the task itself or the focus is on learning and understanding (see Hulleman et al., 2010).	"Your progress in a course should be evaluated by how well you have learned the given subject material and not about how you performed on an exam"; "you…should only compare your wins and losses with yourself"; "one should learn for the sake of learning the content and about oneself"

Codes	Description	In-text example
Motivation	General reference to motivation.	"I am mostly motivated to study…"; "the setting of a particular goal is very important for the motivation of reaching it", "if you are lacking motivation to study"
Value	Reference to the importance or usefulness of the learning or achievement task (see Wigfield & Eccles, 2000).	"Try making a personal connection to the topics as it will help you remember topics"; "try and relate it to personal experience"; "succeeding in school is very important"
Effort	General reference to effort, working hard, trying hard, or persisting.	"I would advise him/her to put more effort into studying"; "putting more time and effort in your studies"; "with the goal of trying your hardest"
Emotion	General reference to an emotion.	"does not get bored when studying for an exam", "can actually cause you anxiety"; "you will end up successful and happy"

Note. There is no overlap between codes.

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