Learning and Instruction 62 (2019) 37–48

Contents lists available at ScienceDirect

Learning and Instruction

journal homepage: www.elsevier.com/locate/learninstruc

Unintended consequences of framing a utility-value intervention in two-year colleges

Elizabeth A. Canning[a,*], Stacy J. Priniski[b], Judith M. Harackiewicz[b]

[a] Indiana University, USA
[b] University of Wisconsin, Madison, USA

ABSTRACT

Utility-value (UV) writing interventions help students find the personal relevance of course material to promote interest and performance. However, little is known about how best to frame the intervention, particularly in the 2-year college context where students have more varied backgrounds than the samples previously studied. Using a randomized field experiment, we tested two ways of framing a UV writing intervention (student-framed vs. instructor-framed examples of UV), against a control assignment. Contrary to previous research, we found that students struggling in the course became less interested and perceived less utility value overall in UV conditions, compared to the control. The student-framed UV intervention made the course more interesting for students who were doing well in the course, but decreased grades for students struggling in the course, compared to the instructor-framed UV intervention. We examine psychological (e.g., confidence, engagement) and cognitive (linguistic indicators of cognitive processing) variables as mechanisms.

1. Introduction

When students encounter subjects or tasks that do not seem personally useful, they may become disinterested. Cultivating situational interest—a positive emotional state aroused by features of an activity or task—is paramount for motivating students in introductory courses, because interest is linked to more time studying, greater investment in learning, and academic performance (Hidi & Harackiewicz, 2000; Renninger & Hidi, 2011). One way to develop interest and promote performance in introductory courses is to help students discover the value or usefulness of the course material (Hidi & Harackiewicz, 2000). One type of value that has proven to be a powerful antecedent of interest and performance is *utility value* (Eccles & Wigfield, 2002; Harackiewicz, Durik, Barron, Linnenbrink- Garcia, & Tauer, 2008; Wang, 2012). A person finds utility value (UV) in a task if they believe it is personally useful and relevant beyond the immediate situation, for other tasks or aspects of a person's life (Eccles & Wigfield, 2002). Thus, when students perceive greater UV in their courses, they experience greater interest in the topic and achieve higher performance in the course (Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008; Wang, 2012).

1.1. Utility-value interventions

Research suggests that it is possible to promote perceived UV, interest, and course performance with writing interventions that have students write about the utility value and relevance of course topics in their own life (Harackiewicz, Tibbetts, Canning, & Hyde, 2014). These UV interventions are based in Eccles' expectancy-value model (Eccles & Wigfield, 2002), which posits that perceived expectancies for success and subjective task values together determine students' achievement-related choices and performance. Eccles (Eccles, 2009; Eccles et al., 1983) identified four types of subjective task values: intrinsic, utility, attainment, and cost. Of these values, perceived UV may be most amenable to intervention (Gaspard et al., 2015; Harackiewicz, Tibbetts, et al., 2014).

UV interventions have been shown to work best for students who doubt their competence and for those with a history of poor performance (Harackiewicz, Canning, Tibbetts, Priniski, & Hyde, 2016; Hulleman, Godes, Hendricks, & Harackiewicz, 2010; Hulleman & Harackiewicz, 2009; Hulleman, Kosovich, Barron, & Daniel, 2017). They have also been found to promote performance for underrepresented students who struggle in introductory science courses (Harackiewicz et al., 2016). For example, Hulleman et al. (2010) implemented a UV writing intervention in an introductory psychology class at a 4-year university. They found that students who had performed poorly on an early exam and who wrote about UV reported more interest in the course at the end of the semester when compared to those in the control group. In introductory biology courses at a 4-year university a UV intervention was successful in reducing the achievement gap for first-generation underrepresented minority students by 61% (Harackiewicz et al., 2016) and increasing grades, course

* Corresponding author. Indiana University, 1101 E. 10th Street, Bloomington, IN, 47405, USA.
E-mail address: canning@iu.edu (E.A. Canning).

https://doi.org/10.1016/j.learninstruc.2019.05.001
Received 25 June 2018; Received in revised form 29 April 2019; Accepted 6 May 2019
Available online 21 May 2019
0959-4752/

retention, and majoring intentions for majority students (Canning et al., 2018).

1.2. Two-year colleges

Although UV interventions implemented in 4-year institutions have been shown to promote a number of positive academic outcomes, questions remain about how to implement this intervention in more diverse contexts, such as 2-year colleges. Students enrolled in 2-year colleges are more heterogeneous in terms of age, race/ethnicity, and high school preparation, compared to students enrolled in 4-year institutions (Horn & Nevill, 2006). For example, 2-year college students are more likely to come from disadvantaged backgrounds, have families to care for, and work full-time compared to students at 4-year colleges (Horn & Nevill, 2006). On average, students attending 2-year colleges are less likely to have earned a high school diploma, and almost half enroll in remedial or developmental education courses (Bailey, Jeong, & Cho, 2010; Horn & Nevill, 2006; Perin, 2013; Perin, Keselman, & Monopoli, 2003). Given the varying degrees of academic preparation in 2-year college classrooms, it may be particularly difficult for instructors to keep everyone engaged with their assignments and interested in their courses. For instance, students who are struggling to keep up with the material may lose interest if the material is too difficult. In contrast, students who are doing well in a class may become bored or frustrated if the material is not novel or challenging enough.

One challenge of implementing a UV intervention in 2-year colleges is that some students might think the UV writing assignments are too challenging. Possibly heightened by students' experiences in past academic contexts, many 2-year college students lack confidence in their writing skills, which leads to avoidant strategies, lack of effort, attrition, and poor performance (Bickerstaff, Barragan,& Rucks-Ahidiana, 2017; Cox, 2009). In particular, assignments that are too challenging for students can decrease confidence and lead to disengagement with the assignment. For instance, Bickerstaff and colleagues (2017) interviewed nearly 100 students enrolled at 2-year colleges and found that uncertainty about how to approach assignments was a key theme when students became disengaged with the course. One student recalled a challenging assignment, “I was upset …. But I didn't know how to do anything about it, first of all. And then I just gave up because I thought it was going to be difficult anyway” (Bickerstaff, Barragan, & Rucks-Ahidiana, 2012, p. 8). Without proper instructional supports, the UV writing assignment might be too challenging for students, causing disengagement.

Another challenge of implementing a UV intervention in this context is that 2-year college students struggle with college-level writing (Perin, 2013; Perin et al., 2003). For example, 23% of 2-year college students enroll in remedial writing courses, compared to only 9% of 4-year college students (Bailey, Jenkins, & Leinbach, 2005). The UV intervention as implemented in previous work (e.g., Harackiewicz et al., 2016) may be more difficult for less prepared students because it requires students to construct essays that synthesize course material. As implemented in 4-year university contexts, the UV writing assignment requires a high level of conceptual work and writing skills, which might prove more challenging for students with less academic preparation and poorer writing skills. In sum, UV interventions may have more variable effects in the 2-year context, given the diversity of students’ academic backgrounds, lack of confidence, and poorer writing skills. Therefore, additional instructional supports may be necessary in the 2-year college context, to help students discover and write about personally-relevant connections.

1.3. Framing utility value writing interventions

Instructional scaffolding is the process by which teachers (or more knowledgeable peers) guide students’ learning and thinking, so that students can solve problems or develop ideas that would otherwise be out of reach (McNeill, Lizotte, Krajcik, & Marx, 2006; Puntambekar & Kolodner, 2005; Vygotsky, 1978). In the case of a UV intervention, providing students with examples of UV information may provide instructional support to help students generate their own personalized examples of how the topic relates to them. Whereas the UV intervention implemented in 4-year institutions provided either no examples of utility value connections (Hulleman et al., 2010) or only brief, hypothetical examples of utility value connections (Harackiewicz et al., 2016), more extensive UV examples may be helpful for 2-year college students. Providing students with some examples of UV connections may help struggling students generate UV examples on their own through the process of internalization (Gallimore & Tharp, 1990; Rogoff, 1990). Thus, providing examples of UV connections may guide students to think more deeply about the value of coursework and internalize the utility-value connections, enabling them to generate more personalized examples on their own.

Providing instructional supports for the UV intervention may prove difficult, however, because studies have found that providing examples of UV connections (i.e., directly-communicated UV information) can sometimes be threatening for students who lack confidence in their ability to do well (Canning & Harackiewicz, 2015; Durik & Harackiewicz, 2007; Durik, Hulleman, & Harackiewicz, 2015; Durik, Shechter, Noh, Rozek, & Harackiewicz, 2015). In one experiment, Durik and Harackiewicz (2007) found that participants with high initial interest reported even greater interest in the topic after receiving a message containing examples of UV connections, whereas the same message undermined interest for individuals with low initial interest. Other studies have replicated these effects and found that providing examples of UV connections can reduce interest for students with low confidence, but increase interest for those with high confidence, suggesting that UV examples can be threatening for certain students (Canning & Harackiewicz, 2015; Durik, Shechter et al., 2015).

Canning and Harackiewicz (2015) tested different strategies to reduce the threat of directly-communicated UV information, so that less confident students could benefit from this type of instructional support. In one study, they found that the combination of both directly-communicated UV and self-generated UV (i.e., writing a short essay about the UV of the material) had a synergistic effect for interest and performance, particularly for less confident students. In other words, self-generated UV was most effective for less confident students when supported by examples of UV information. Thus, directly-communicated UV information might be too threatening by itself for individuals who lack confidence (Durik, Hulleman, et al., 2015), but once these individuals were given the chance to process the information in their own words, directly communicated UV was actually helpful, boosting the efficacy of the self-generated UV intervention.

1.4. Teacher vs. student utility value information

Another strategy hypothesized to reduce the threat of directly-communicated UV information is to change the source of the information. Teachers often provide students with examples in order to help them understand the material or to facilitate the transfer of knowledge to other problems and situations (McNeill et al., 2006; Puntambekar & Kolodner, 2005). However, providing examples may not be the best approach when communicating UV because messages from teachers or other authority figures about the importance of a task can create feelings of pressure for individuals who are unsure if they can succeed, causing them to disengage from the task (Deci & Ryan, 1985; Ryan & Connell, 1989). Therefore, it may be counterproductive for instructors to tell some of their students why the material is relevant or useful.

An alternative approach is to have student peers communicate how the material connects to everyday life. Peers have a substantial influence on students’ motivation and enjoyment of school (Berndt, Laychak, & Park, 1990; Ryan, 2000, 2011; Thoman, Muragishi, &

Smith, 2017; Thoman, Sansone, Fraughton, & Pasupathi, 2012) and peer tutoring, in which students teach other students, has been shown to be particularly effective in increasing engagement and learning (Greenwood, Delquadri, & Hall, 1989; King, Staffieri, & Adelgais, 1998). Indeed, in one study conducted with a small sample of pre-service teachers enrolled in an online educational psychology course, peer-generated UV information was more effective at increasing course performance, compared to instructor-generated UV (Shin, Ranellucci, & Roseth, 2017). Ultimately, UV writing interventions aim to have students generate personal examples of UV and it may be easier for students to come up with their own personalized connections when they first see that their peers also can make these connections. Thus, UV examples from a peer could help students generate more value for themselves in the writing exercise, compared to receiving the same examples, but from instructors.

Peer-generated UV information may help students generate more value, but it could also produce some negative outcomes, such as facilitating social comparison processes or making some students feel inadequate. For instance, well-written examples of UV information, when generated by a peer, may create more pressure for students who believe they can't generate such good examples. No study to our knowledge has tested the effects of peer vs. instructor generated UV information in combination with a UV writing intervention, and thus our hypotheses are tentative. It is important to understand whether the source of UV information can change the way students perceive value, in order to provide the additional instructional supports that some students may need while also reducing the threat of directly-communicated UV information.

1.5. The current study

In the current study, we adapted the UV writing intervention previously implemented at a 4-year institution (Harackiewicz et al., 2016) to include examples of UV connections. Based on previous research conducted at 4-year universities (Harackiewicz et al., 2016; Hulleman et al., 2010), we hypothesized that the UV intervention adapted for the 2-year college context would improve interest and performance for students who are struggling in introductory courses (Hypothesis 1). We also wanted to test different strategies for reducing the threat of providing students with UV examples. Using a 3-cell design, we compare two different ways of framing the UV intervention (i.e., including UV examples from former students versus the instructor) to a control writing assignment. We hypothesized that UV examples from peers would increase interest and performance for students struggling in the class (Hypothesis 2).

2. Methods

2.1. Participants

We implemented the UV intervention in a double-blind, randomized experiment in introductory biology and psychology courses taught by 11 instructors (7 biology, 4 psychology). We chose introductory biology and psychology courses, because previous research in the 4-year context implemented UV interventions in similar content courses (Canning et al., 2018; Harackiewicz et al., 2016; Hulleman et al., 2010; Priniski et al., in press; Rosenzweig et al., 2018). These courses were taught at six 2-year college campuses across the state of Wisconsin. The 2-year college system in Wisconsin consists of a network of 13 freshman/sophomore campuses that offer associate degrees and prepare students to transfer to baccalaureate programs.

Of the 521 students enrolled in participating introductory biology and psychology courses, 415 students were included in the final sample. To be included in the analyses, students must have given consent for access to their academic records, completed at least one of the writing assignments, and completed the course (34 students did not consent; 27 did not complete any of the writing assignments, and 45 dropped the course).[1] Consistent with U.S. 2-Year college demographics (Horn & Nevill, 2006), participants were 62% female (38% male) and 57% first-generation (FG) college students (i.e., those for whom neither parent obtained a 4-year college degree, compared to continuing-generation (CG) students, who have at least one parent with a 4-year degree). Participants were slightly younger than typical 2-year college students (national average = 24) with an average age of 19.57 (SD = 3.34). In terms of race/ethnicity, participants were 79% White, 10% Hispanic, 3% African American, 3% Southeast Asian, 3% Asian/Asian American, and 2% Native American participants. As a comparison, 2-year college students in the U.S. are on average 60% White, 14% Hispanic, and 15% African American. In this study underrepresented racial minority (URM) students were defined as Hispanic, African American, Southeast Asian, and Native American. Participants were 64% introductory biology students and 36% introductory psychology students.

2.2. Overview of procedure

In each course we collected baseline measures of attitudes about the course (i.e., course belonging, perceived course difficulty, perceived preparedness, competence valuation, and confidence about performance) and demographic information during the first or second meeting of class. We implemented the UV intervention with a writing assignment three times during the course. Students were randomly assigned to one of three conditions (control, student-framed UV, or instructor-framed UV), in a double-blind design. At approximately the 13th week of the semester, we collected measures of perceived UV, interest in biology/psychology, and attitudes about the course. Performance in the course was measured with exam scores (provided by the instructors) and final course grades (obtained from students' academic records).

2.3. Utility-value intervention

The UV intervention was administered as follows: All students were assigned three 500-word essay assignments, for credit, during the course. The course management site was customized so that students could receive individualized writing assignments that corresponded to their condition and could not view other students' writing assignments. Students were given approximately 1 week to complete each essay and turned in their assignments online. The assignment instructions were the same each time; all students were asked to pick a topic that was covered in the course in the preceding two-week period, formulate a question, and write about it. In the control condition, the assignment instructed students to address the question by briefly summarizing the main points covered in the course. In UV writing conditions, students were asked to explain how the topic was relevant to their own life or useful to them.

Both UV writing assignments contained examples of UV connections that students might write about. The examples were tailored for each course with the help of the instructor, to ensure appropriate content. The content of the examples were the same across UV conditions and only the framing of the examples differed between UV conditions. In the instructor-framed UV condition those examples were presented as being generated by the instructor:

Here are some examples of an approach you could take:

[1] We chose to include in the analyses only students who had completed at least one of the writing assignments to estimate the effect of the intervention in 2-year colleges with comparable rates of compliance in previous research. For instance, in a 4-year university sample (Harackiewicz et al., 2016), 99% of students completed at least one assignment and 95% of students completed all three assignments. Importantly, consent rate, essay completion, and dropout rate did not vary significantly by condition.

This week we've been talking about osmosis in class and you may have finally realized why your dad told you once to use honey when you cut yourself shaving, since you were out of Neosporin. You might have thought this was weird until you learned about osmosis and how honey can work as an anti-bacterial ointment, because the sugar to water concentration in the honey is so large that no bacteria can survive. Honey is just one example of how important osmosis is to your life.

The student-framed UV condition presented conceptually similar UV connections in the form of quotations from former students in the course:

Here are some examples of approaches that former students have taken:

> "This week we've been talking about osmosis in class and I finally realized why my dad told me once to use honey when I cut myself shaving, since we were out of Neosporin. I thought this was weird until I learned about osmosis and how honey can work as an anti-bacterial ointment, because the sugar to water concentration in the honey is so large that no bacteria can survive. Honey is just one example of how important osmosis is to my life."

The assignments were fully integrated into the curriculum, and instructors decided how much course credit to allot each assignment (ranging from 1% to 4% of the final grade in the course). Course credit did not differ between the UV and control assignments. Instructors also determined the timing of the assignments throughout the semester.

2.4. Measures

During the first week of classes, research assistants administered a baseline questionnaire that assessed baseline levels of attitudes about the biology/psychology course and demographic information. At approximately the 13th week of the 15-week semester, research assistants administered a final questionnaire measuring attitudes about the course, and interest and perceived UV for biology/psychology generally. These constructs have been validated in previous research in the domain of psychology (Hulleman, Durik, Schweigert, & Harackiewicz, 2008; Linnenbrink-Garcia et al., 2010) and biology (Harackiewicz et al., 2014, 2016). All questionnaire items were answered on a 7-point scale ranging from "not at all true" to "very true" or "not at all" to "a lot", unless otherwise noted. Scale scores represent the mean of constituent items. Missing data (less than 8% on each measure) were handled with multiple imputation by fully conditional specification with 10 imputed data sets (Rubin, 1987). Pooled estimates and standard errors are reported when imputation occurred.

Attitudes about the course. Attitudes about the course were measured on the baseline questionnaire (first week of the semester) and the final questionnaire (13th week of the semester). Course belonging uncertainty was measured with one item ("I'm not sure I belong in this course"). Perceived course difficulty was measured with one item ("I think this course is difficult"). Perceived preparedness was measures with two items ("My high school classes provided me the right background for this course," "My high school education prepared me well for this course," $\alpha_{baseline} = 0.91$, $\alpha_{final} = 0.93$). Competence valuation (Harackiewicz & Sansone, 1991) was measured with two items ("It is important to me to do well in this course," "I want to do well in this course," $\alpha_{baseline} = 0.68$, $\alpha_{final} = 0.78$). Confidence about performance was measured with three items ("I am confident that I will do well in this course," "I expect to get a good grade in this course," "I am confident that I can obtain a final grade of B or better in this course", $\alpha_{baseline} = 0.82$, $\alpha_{final} = 0.92$).

Interest and perceived utility value. Interest and perceived UV were measured on the final questionnaire (13th week of the semester). Interest was measured with five items ("I'm really looking forward to learning more about [biology/psychology]," "[Biology/psychology] fascinates me," "I think the field of [biology/psychology] is very interesting," "I'm excited about [biology/psychology]," "To be honest, I just don't find [biology/psychology] interesting," reversed, $\alpha = 0.92$). Perceived UV was measured with five items ("The study of [biology/psychology] is personally important to me," "I think what we are learning in this course is important," "The study of [biology/psychology] is personally meaningful to me," "The material we are studying in this course is useful for everyone to know," "This course is important to my future," $\alpha = 0.87$).

First exam grade. Initial performance in the course was measured with students' first exam grade (0–110 scale). Performance on the first exam was standardized across courses and used as a moderator for all analyses. We chose first exam grade as a moderator, because previous research has found that a UV intervention implemented in an introductory psychology course was particularly effective for students with low exam grades (Hulleman et al., 2010), and this variable should identify students who struggle in the class. By standardizing across courses we cannot separate instructor-specific grading tendencies and true ability differences; instead, we use students' performance on the first exam to identify students across courses who received a low exam grade. The timing of the first exam varied across courses (i.e., 9 courses completed the first exam during the 4th or 5th week of the semester, 2 courses completed the first exam during the 6th or 7th week of the semester).[2]

Course grade. Final course grades were obtained from students' academic records at the end of the semester (0–4.0 scale).

Coding of articulated utility value. The first two writing assignments were coded for the level of UV articulated in the essay, using a validated coding scheme (Canning et al., 2018; Harackiewicz et al., 2016). We chose to examine the first two essays, because we wanted to capture students' initial reactions to the writing assignment. All but three students completed either the first or second essay assignment, whereas only 88% of students completed the third essay assignment. Including the 3rd essay in the analyses did not change the results; however, we wanted to include as much of the full sample as possible in the analysis, so we report results from the first two essays.

Research assistants coded the assignments on a 0–4 scale based on how specific and personal the UV connection was to the individual. A "0" on this scale indicates no utility; a "1" indicates general utility applied to humans generically; a "2" indicates utility that is general enough to apply to anyone, but is applied to the individual; a "3" indicates utility that is specific to the individual; and a "4" indicates a strong, specific connection to the individual that includes a deeper appreciation or future application of the material. UV scores from the first two essays were summed to create an overall measure of articulated UV. Inter-rater reliability with this coding rubric was high, with two independent coders providing the same score on 88% of essays. Disagreements were resolved by discussion.

3. Results

3.1. Overview

Table 1 presents descriptive statistics and intercorrelations for all measures. Although students were randomly assigned to condition at the student level, we used hierarchical linear modeling (HLM) to account for the nested structure of the data (Raudenbush & Bryk, 2002).

[2] In seven courses the first writing assignment was assigned before the first exam took place. In order to use first exam grade as a moderator of the intervention effects, we tested to make sure there was no treatment effect on first exam grade for these courses. We found no evidence of a treatment effect for the UV intervention, $t(335) = -0.20$, $\beta = -0.01$, $p = .83$, or UV framing, $t(335) = 0.88$, $\beta = 0.05$, $p = .38$, on the first exam grade. Thus, we proceeded to use this variable as a moderator in the primary analyses to be consistent with prior research.

Table 1
Zero-order correlations and descriptive statistics.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. First Exam Grade	–														
2. Course Grade	.67**	–													
3. Interest (final)	.22**	.19**	–												
4. Perceived Utility Value (final)	.26**	.22**	.85**	–											
5. Articulated Utility Value	.02	.13**	-.02	-.03	–										
6. Competence Valuation (final)	.30**	.39**	.48**	.51**	-.09	–									
7. Competence Valuation (baseline)	.06	.11*	.23**	.26**	-.06	.44**	–								
8. Confidence (final)	.59**	.69**	.44**	.45**	.04	.50**	.15**	–							
9. Confidence (baseline)	.12*	.10*	.32**	.33**	-.12*	.34**	.39**	.37**	–						
10. Belonging Uncertainty (final)	-.36**	-.41**	-.40**	-.36**	-.04	-.31**	-.11*	-.48**	-.18**	–					
11. Belonging Uncertainty (baseline)	-.06	-.08	-.26**	-.26**	.01	-.30**	-.24**	-.16**	-.36**	.33**	–				
12. Perceived Preparedness (final)	.24**	.22**	.36**	.41**	-.01	.29**	.11*	.40**	.23**	-.24**	-.14**	–			
13. Perceived Preparedness (baseline)	.03	.04	.24**	.28**	-.04	.23**	.14**	.15**	.36**	-.11*	-.22**	.67**	–		
14. Course Difficulty (final)	-.28**	-.23**	-.30**	-.25**	-.05	-.16**	−0.02	-.46**	-.21**	.39**	.14**	-.33**	-.21**	–	
15. Course Difficulty (baseline)	.02	.01	-.10	-.06	-.03	.01	-.01	-.09	-.34**	.18**	.33**	-.04	-.16**	.36**	–
Scale Range	0–110	0–4	1–7	1–7	0–8	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7
N	415	415	380	380	415	380	405	380	405	380	405	380	405	380	405
Mean	77.85	2.61	5.11	4.98	4.21	6.36	6.61	5.19	5.64	2.45	2.11	4.47	4.67	3.89	3.81
SD	14.80	1.08	1.45	1.27	2.40	.75	.61	1.43	.92	1.52	1.29	1.67	1.50	1.54	1.38

*$p < .05$, **$p < .01$.

We tested a two-level random-intercept model in which students were nested within eleven different instructors. The intraclass correlation coefficient was small; between-instructor variance accounted for only 5.88% of the variance in course grade, 0.99% in interest, and 1.00% in perceived UV. Although this analysis demonstrated that the nesting of students would not have a large effect on the analyses compared to multiple regression models, we modeled the nesting structure so that accurate standard errors would be obtained (Raudenbush & Bryk, 2002). Comparisons of regression and HLM results for the primary analyses are presented in Table 2. Analyses with HLM and regression yielded consistent results. Regression results are reported here so that effect sizes (betas) can be reported.

Two orthogonal contrasts addressed the two primary research questions about the UV intervention: (1) Is the UV intervention effective in the 2-year college context? and (2) What is the optimal type of framing? The UV versus Control contrast addressed the first question and compared the two UV interventions to the control condition (student-framed UV, +1, instructor-framed UV, +1, Control, -2). The UV Framing contrast addressed the second question and compared the two UV interventions directly (student-framed UV, +1, instructor-framed UV, −1, Control, 0). Performance on the first exam (standardized) was tested as the moderator of treatment effects. The final model contained nine terms: two orthogonal contrasts, first exam grade, two interactions between the contrasts and the first exam grade, and four covariates: URM status (Majority = −1, URM = 1), FG status (CG = −1, FG = 1), gender (female = 1, male = −1), and course type (biology = 1, psychology = −1).[3] The four covariates were included in all analyses. We report significant effects on each of the three primary dependent variables: course grade, interest, and perceived UV.[4] To interpret significant interactions, predicted values were generated for individuals one standard deviation below and above the mean on first exam grade.

[3] We also tested interactions between the two UV contrasts and URM status, FG status, and gender; however, none were significant and were therefore trimmed from the model.

[4] We tested for outliers for each dependent variable. Two outliers were found for interest, 2 were found for perceived UV, and 26 were found for course grade (all were values of 0 or "F"). All analyses remained consistent when outliers were excluded; therefore, we report analyses with the full, unrestricted sample.

3.2. Manipulation check: articulated utility value

In order to test whether or not the UV interventions caused participants to write about more UV in their essays than those in the control condition, we examined articulated UV. As expected, students in the UV conditions articulated significantly more UV (i.e., made more personal connections to curricular content) in their essays ($M = 5.36$, $SD = 1.89$) than those in the control condition ($M = 1.94$, $SD = 1.53$), t (405) = 18.96, β = 0.68, $SE = 0.04$, $p < .001$. This important manipulation check indicates that the UV interventions were successful in encouraging students to make personal connections with the course material in their writing assignments. Consistent with our hypothesis, students in the student-framed UV condition articulated significantly more UV in their essays ($M = 5.59$, $SD = 2.01$) than those in the instructor-framed UV condition ($M = 5.14$, $SD = 1.75$), t (405) = 2.18, β = 0.08, $SE = .04$, $p = .03$. Even though the content of the UV examples were the same across UV conditions, the student-framed UV intervention helped students to make more personal connections than the instructor-framed UV intervention. However, the effect size of this difference was small.

3.3. Test of intervention effectiveness

To test the effectiveness of the UV writing interventions (Hypothesis 1), we examined the UV versus Control contrast and its interaction with early performance in the course (first exam grade) on each of the three primary dependent variables: interest, perceived UV, and course grade. A significant two-way interaction between the UV versus Control contrast and first exam grade on interest, β = 0.14, $SE = 0.05$, $p = .003$, and perceived UV, β = 0.11, $SE = 0.05$, $p = .017$, indicated that the effects of the UV interventions depended on students' performance on the first exam (see Fig. 1). Simple effects were calculated to test the effect of the UV interventions for students one standard deviation below and above the mean on first exam grade. For students struggling in the course, the UV writing interventions decreased interest, t (405) = 2.71, β = −0.18, $SE = 0.07$, $p = .007$, and perceived UV, t (405) = 2.09, β = −0.14, $SE = 0.07$, $p = .037$, compared to the control condition. Even though all students, on average, were articulating more UV in the UV conditions, struggling students did not benefit from this type of writing. In fact, struggling students became less interested and perceived less UV overall in UV conditions, compared to the control. For high-performing students, the UV interventions did not affect interest or perceived UV. Notably, there was not a significant intervention main

Table 2
Effects of the UV Interventions on Course Grade, Interest, and Perceived Utility value.

Predictor	Course Grade					
	Regression			HLM		
	β	*t (405)*	*p*	γ	*F (df)*	*p*
UV vs. Control Contrast	-.05	−1.50	.135	-.04	2.16 (1, 397)	.142
UV Framing Contrast	-.02	−0.59	.557	-.02	0.12 (1, 397)	.732
First Exam Grade	.66	18.23	.000	.77	379.20 (1, 405)	.000
UV vs. Control x Exam Grade	-.01	−0.22	.829	-.01	0.14 (1, 398)	.707
UV Framing x Exam Grade	.09	2.39	.017	.14	8.61 (1, 399)	.003
FG	.04	1.13	.260	.03	0.82 (1, 400)	.365
URM	-.00	−0.09	.932	.01	0.06 (1, 402)	.809
Gender	.17	4.88	.000	.18	22.04 (1, 399)	.000
Course Type	.10	2.87	.004	.13	2.20 (1, 9)	.172

Predictor	Interest					
	Regression			HLM		
	β	*t (405)*	*p*	γ	*F (df)*	*p*
UV vs. Control Contrast	-.04	−0.94	.349	-.04	0.89 (1, 398)	.347
UV Framing Contrast	.07	0.85	.397	.07	0.74 (1, 399)	.391
First Exam Grade	.40	5.79	.000	.41	32.86 (1, 330)	.000
UV vs. Control x Exam Grade	.14	2.95	.003	.14	8.60 (1, 403)	.004
UV Framing x Exam Grade	.19	2.22	.027	.19	5.01 (1, 405)	.026
FG	.09	1.30	.194	.09	1.52 (1, 405)	.218
URM	.19	2.11	.036	.19	4.56 (1, 402)	.033
Gender	.23	3.33	.001	.23	10.90 (1, 405)	.001
Course Type	-.18	−2.57	.011	-.17	4.42 (1, 7)	.071

Predictor	Perceived Utility Value					
	Regression			HLM		
	β	*t (405)*	*p*	γ	*F (df)*	*p*
UV vs. Control Contrast	-.03	−0.60	.550	-.03	0.38 (1, 398)	.540
UV Framing Contrast	.05	0.72	.470	.05	0.55 (1, 398)	.457
First Exam Grade	.37	6.04	.000	.38	36.61 (1, 364)	.000
UV vs. Control x Exam Grade	.10	2.40	.017	.10	5.76 (1, 401)	.017
UV Framing x Exam Grade	.15	2.08	.038	.16	4.55 (1, 403)	.033
FG	.03	0.52	.605	.02	0.13 (1, 405)	.720
URM	.18	2.34	.020	.19	5.86 (1, 405)	.016
Gender	.25	4.04	.000	.24	15.87 (1, 403)	.000
Course Type	.01	0.13	.896	.03	0.11 (1, 8)	.751

Note. UV vs. Control Contrast (student-framed UV, +1, instructor-framed UV, +1, Control, −2), UV Framing Contrast (student-framed UV, +1, instructor-framed UV, −1, Control, 0), FG = First-generation (FG = +1, Continuing-generation = −1) URM = Underrepresented Minority (URM = +1, Majority = −1), Gender (Female = +1, Male = −1), Course Type (biology = 1, psychology = −1).

effect or interaction on course grade, indicating that the UV interventions had no effect on performance in the course, compared to the control condition.

3.4. Test of utility value framing

To test whether the student-framed UV condition was more effective for struggling students (Hypothesis 2), we examined the UV Framing contrast and its interaction with first exam grade. There was a significant two-way interaction between the UV Framing contrast and first exam grade on all three outcome measures: interest, β = 0.10, *SE* = 0.05, *p* = .027, perceived UV, β = 0.10, *SE* = 0.05, *p* = .038, and course grade, β = 0.09, *SE* = 0.04, *p* = .017 (see Fig. 1). Simple slope analyses revealed that the student-framed UV intervention decreased grades for students struggling in the course, *t* (405) = 2.15, β = −0.11, *SE* = 0.05, *p* = .032, compared to the instructor-framed UV intervention, whereas performance did not differ among high-performance students *t* (405) = 1.29, β = 0.07, *SE* = 0.07, *p* = .197. In contrast, high-performing students reported more interest, *t* (405) = 2.16, β = 0.15, *SE* = 0.07, *p* = .031, and perceived UV, *t* (405) = 1.97, β = 0.13, *SE* = 0.07, *p* = .049, in the student-framed UV condition, compared to the instructor-framed UV condition, whereas interest, *t* (405) = 1.01, β = −0.07, *SE* = 0.07, *p* = .311, and perceived UV, *t* (405) = 1.00, β = −0.07, *SE* = 0.07, *p* = .319, did not differ among struggling students. In other words, the student-framed UV condition had a negative effect on grades for struggling students, but had a

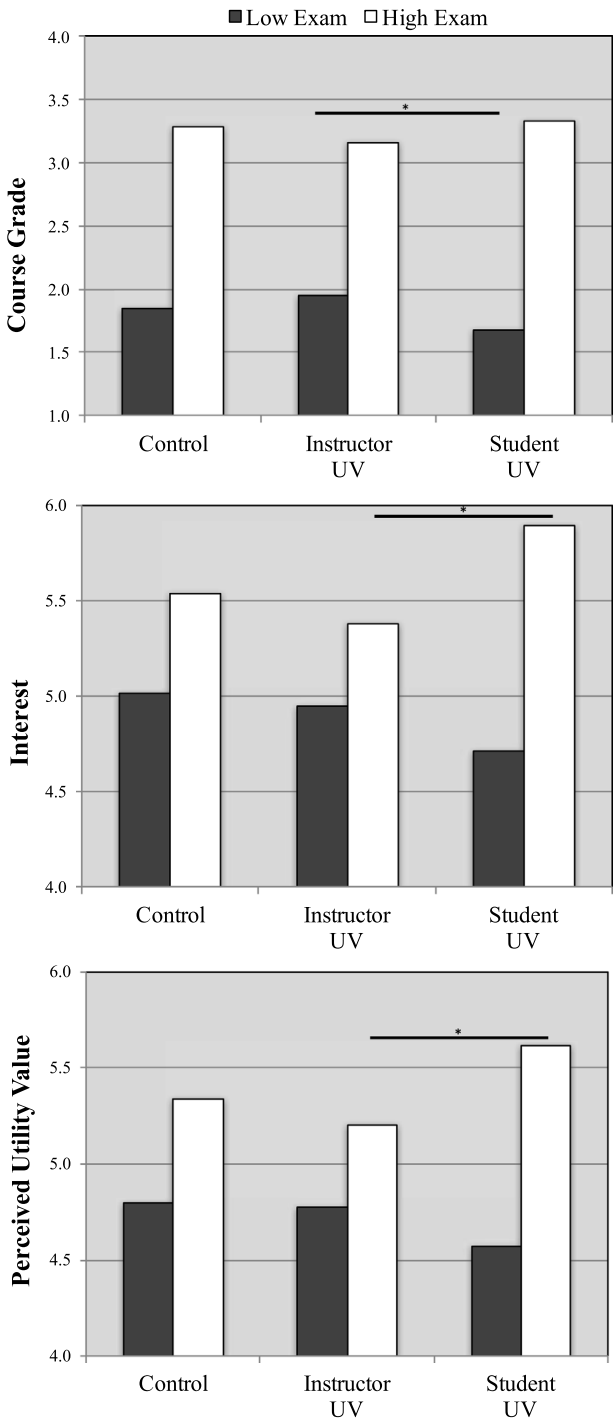

Fig. 1. Course grade, interest, and perceived utility value as a function of condition and first exam grade. Predicted values are computed from the mean of exam grade (low = −1 SD, high = +1 SD).

positive effect on interest and perceived UV for students doing well in the course.

3.5. Exploratory analysis of process variables

Did the UV interventions threaten struggling students? In contrast to previous UV intervention research, the UV interventions undermined interest and perceived UV for struggling students. The student-framed UV intervention in particular decreased grades for struggling students, compared to the instructor-framed UV intervention. It could be that in the 2-year college context, UV interventions are more threatening for struggling students, causing disengagement. Writing about the utility of course material may put too much pressure on students who are already struggling in the course. In contrast, the UV assignments may have been easier for high-performing students, causing a boost in confidence about their preparation and making them feel like they belong in the course. Therefore, the UV assignments might have opposing effects for students because they were threatening for some (struggling students) but motivating for others (high-performing students).

We conducted a set of exploratory analyses to examined potential mediators of the reported effects. We did not measure threat directly in this study; however, we investigated threat and other negative reactions indirectly by examining students' attitudes about the course (i.e., perceived preparedness, confidence about performance, competence valuation, perceptions of course difficulty, and belonging uncertainty). We tested the primary model described above and controlled for respective baseline measures, in order to assess attitude change throughout the semester (see Table 3 for regression results and Table 4 for predicted values).

Perceived Preparedness. There was a significant two-way interaction between the UV versus Control contrast and first exam grade on perceived preparedness, $\beta = 0.10$, $SE = 0.04$, $p = .004$. Simple slope analyses revealed that struggling students reported less confidence in their preparation in UV conditions, $t\ (404) = 2.23$, $\beta = -0.11$, $SE = 0.05$, $p = .026$, compared to the control condition. In other words, the UV interventions caused struggling students to doubt whether they were well prepared for the course.

Confidence About Performance. There was a significant two-way interaction between the UV versus Control contrast and first exam grade on confidence about performance, $\beta = 0.12$, $SE = 0.04$, $p = .002$. Simple slope analyses revealed that struggling students reported less confidence in UV conditions, $t\ (404) = 2.88$, $\beta = -0.15$, $SE = 0.05$, $p = .004$, compared to the control condition.

Competence Valuation. A significant main effect of the UV versus Control contrast, $\beta = -0.10$, $SE = 0.04$, $p = .014$, indicated that the UV conditions decreased competence valuation relative to the control condition. However, this main effect was qualified by a significant two-way interaction between the UV versus Control contrast and first exam grade, $\beta = 0.10$, $SE = 0.04$, $p = .019$. Simple slope analyses revealed that struggling students reported that they cared less about doing well in the course in UV conditions, $t\ (404) = 3.39$, $\beta = -0.20$, $SE = 0.06$, $p = .001$, compared to the control condition. A decrease in competence valuation is one indication that struggling students became disengaged in the UV conditions. Furthermore, a significant two-way interaction between the UV Framing contrast and first exam grade, $\beta = 0.08$, $SE = 0.04$, $p = .050$, indicated that the student-framed UV intervention decreased competence valuation somewhat for struggling students and increased competence valuation somewhat for high-performing students, compared to instructor-framed UV intervention, though neither simple slope test was significant.

Table 4
Predicted Values for the Interaction Between the UV vs. Control Contrast and First Exam Grade.

	Control		UV Interventions	
	Low Exam	High Exam	Low Exam	High Exam
Interest	5.01	5.54	4.65	5.73
Perceived Utility Value	4.82	5.36	4.53	5.47
Competence Valuation	3.03	3.34	2.82	3.34
Confidence about Performance	1.88	3.22	1.58	3.38
Belonging Uncertainty	2.24	1.31	2.42	1.04
Perceived Preparedness	0.83	1.28	0.57	1.48
Course Difficulty	2.82	2.09	2.99	1.77

Note. Scores could range 1 (low) to 7 (high). Predicted values are computed at −1 SD (low) and +1 SD (high) for first exam grade.

Course Difficulty. There was a significant two-way interaction between the UV versus Control contrast and first exam grade on perceptions of course difficulty, $\beta = -0.11$, $SE = 0.04$, $p = .010$. Simple slope analyses revealed that high-performing students reported that the course was perceived as less difficult in UV conditions, $t\ (404) = 2.41$, $\beta = -0.15$, $SE = 0.06$, $p = .016$, compared to control.

Belonging Uncertainty. There was a significant two-way interaction between the UV versus Control contrast and first exam grade on belonging uncertainty, $\beta = -0.11$, $SE = 0.04$, $p = .011$. Simple slope analyses revealed that high-performing students reported less uncertainty about belonging in the course in UV conditions, $t\ (404) = 2.19$, $\beta = -0.13$, $SE = 0.06$, $p = .029$, compared to control. In other words, the UV interventions caused high-performing students to feel more like they belong in the course.

These analyses suggest that the UV interventions caused struggling students to care less about doing well, lose confidence about their performance, and doubt their preparedness. For students doing well in

Table 3
Effects of the UV interventions on attitudes about the course.

	Competence Valuation			Confidence About Performance			Belonging Uncertainty			Perceived Preparedness			Course Difficulty		
	β	*t*	*p*	β	*t*	*p*	β	*t*	*p*	β	*t*	*p*	β	*t*	*p*
UV vs. Control Contrast	-.10	−2.47	.014	-.04	−1.00	.318	-.02	−0.50	.618	-.01	−0.33	.739	-.03	−0.78	.434
UV Framing Contrast	-.01	−0.26	.795	-.01	−0.35	.729	.05	1.25	.210	-.01	−0.30	.765	-.03	−0.63	.531
First Exam Grade	.28	6.53	.000	.55	14.36	.000	-.38	−8.75	.000	.20	5.73	.000	-.32	−7.04	.000
UV vs. Control x Exam	.10	2.36	.019	.12	3.14	.002	-.11	−2.57	.011	.10	2.88	.004	-.11	−2.60	.010
UV Framing x Exam	.08	1.97	.050	.02	0.65	.516	-.06	−1.41	.160	-.02	−0.70	.484	-.03	−0.65	.515
FG	-.02	−0.57	.569	.01	0.17	.863	-.08	−1.92	.056	.02	0.48	.632	-.12	−2.63	.009
URM	.03	0.83	.409	.02	0.50	.620	-.05	−1.25	.212	.02	0.60	.549	.01	0.23	.819
Gender	.14	3.30	.001	.07	1.93	.054	-.18	−4.21	.000	-.02	−0.44	.659	-.01	−0.27	.786
Course Type	.09	2.08	.038	.09	2.37	.018	.04	0.88	.382	.15	4.22	.000	.05	1.13	.260
Baseline Covariate	.40	9.53	.000	.30	8.09	.000	.28	6.52	.000	.65	18.69	.000	.35	7.93	.000

Note. df = 404. UV vs. Control Contrast (student-framed UV, +1, instructor-framed UV, +1, Control, −2), UV Framing Contrast (student-framed UV, +1, instructor-framed UV, −1, Control, 0), FG = First-generation (FG = +1, Continuing-generation = −1) URM = Underrepresented Minority (URM = +1, Majority = −1), Gender (Female = +1, Male = −1), Course Type (biology = 1, psychology = −1). Baseline Covariate refers to the same measure assessed at baseline.

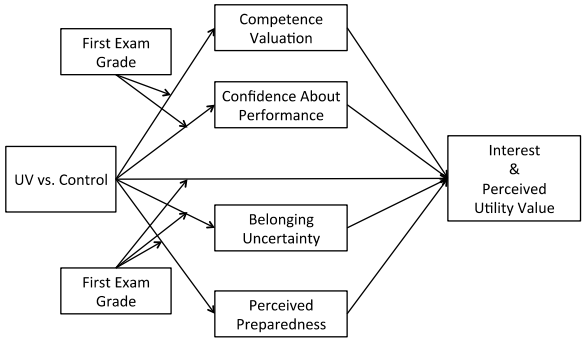

Fig. 2. Moderated mediation model.

the course, the UV interventions had a positive effect, increasing belonging and confidence about their preparedness. Considered together, these findings suggest that the UV interventions may have created pressure for struggling students and made them question their competence, while confirming belonging and competence for high-performing students. A critical question is whether these attitudes about the course mediated the effects of the UV interventions on interest and perceived UV.

3.6. Exploratory test of moderated mediation

We used Hayes' (2013) PROCESS software, which allowed us to test indirect effects of the UV versus Control contrast on interest and perceived UV through each process measure in parallel. Percentile confidence intervals are reported using 5000 bootstrap samples. We first tested a mediation model with all five process measures; however, course difficulty was not a significant mediator for interest or perceived UV, and was therefore trimmed from the final mediation model. The inclusion of course difficulty in the mediation model did not change the results reported here. Fig. 2 illustrates the final mediation model. We did not test mediation models for course grade, because there was not a significant effect of the UV vs. Control contrast on course grade. Estimation of indirect effects in a parallel multiple mediator model allows for a simultaneous test of each mechanism while controlling for all other mediators in the model. Table 5 shows the significance tests for the conditional indirect effects of each process variable for individuals one standard deviation below and above the mean on first exam grade.

Interest. For interest, the index of moderated mediation did not include zero for perceived preparedness, index = 0.024, 95% CI [0.004, 0.047], competence valuation, index = 0.026, 95% CI [0.004, 0.054], and belonging uncertainty, index = 0.016, 95% CI [0.002, 0.038]. Therefore, we can conclude that the indirect effects through these process variables varied significantly as a function of first exam grade. Specifically, perceived preparedness was a significant mediator for students with low first exam grades, indirect effect = −0.027, 95% CI [-0.059, −0.001]. The UV interventions caused struggling students to doubt their preparedness, leading to lower levels of interest. Competence valuation was also a significant mediator for students with low first exam grades, indirect effect = −0.056, 95% CI [-0.102, −0.017]. In other words, the UV interventions caused struggling students to care less about doing well in the course and this decrease in competence valuation led to a decrease in interest. In contrast, belonging uncertainty was a significant mediator for students with high first exam grades, indirect effect = 0.020, 95% CI [0.002, 0.046]. The UV interventions caused students who performed well on the first exam to become more certain about whether they belonged in the course and this increase in belonging led to an increase in interest. There were no significant indirect effects for confidence about performance.

Perceived utility value. Mediation results were similar for perceived UV: the index of moderated mediation did not include zero for perceived preparedness, index = 0.024, 95% CI [0.004, 0.045], and competence valuation, index = 0.023, 95% CI [0.004, 0.052]. Perceived high school preparation was a significant mediator for students with low first exam grades, indirect effect = −0.027, 95% CI [-0.056, −0.001]. Competence valuation was also a significant mediator for students with low first exam grades, indirect effect = −0.049, 95% CI [-0.096, −0.015]. The UV interventions caused struggling students to doubt their preparation and care less about doing well in the course, leading to lower levels of perceived UV. There were no significant indirect effects for belonging uncertainty or confidence about performance.

3.7. Exploratory text analyses

Next we explored the content of the first two essays that students

Table 5
Moderated mediation of effects of the utility value interventions on interest and perceived utility value.

Index of Moderated Mediation		Interest				Perceived Utility Value			
Mediator		Index	Boot SE	Boot LLCI	Boot ULCI	Index	Boot SE	Boot LLCI	Boot ULCI
Competence Valuation		.026	.013	.004	.054	.023	.012	.004	.052
Confidence About Performance		.016	.011	-.001	.042	.013	.009	-.001	.032
Belonging Uncertainty		.016	.010	.002	.038	.008	.007	-.004	.024
Perceived Preparedness		.024	.011	.004	.047	.024	.010	.004	.045
Conditional Indirect Effect									
Mediator	First Exam Grade	Boot indirect effect	Boot SE	Boot LLCI	Boot ULCI	Boot indirect effect	Boot SE	Boot LLCI	Boot ULCI
Competence Valuation	Low	-.056	.022	-.102	-.017	-.049	.021	-.096	-.015
Competence Valuation	High	-.003	.014	-.029	.028	-.003	.012	-.025	.024
Confidence About Performance	Low	-.022	.016	-.059	.002	-.017	.012	-.045	.001
Confidence About Performance	High	.011	.001	-.005	.033	.008	.008	-.003	.026
Belonging Uncertainty	Low	-.013	.013	-.041	.008	-.006	.008	-.027	.005
Belonging Uncertainty	High	.020	.012	.002	.046	.009	.008	-.005	.027
Perceived Preparedness	Low	-.027	.015	-.059	-.001	-.027	.014	-.056	-.001
Perceived Preparedness	High	.021	.013	-.003	.047	.021	.013	-.003	.047

Note. Bootstrap sample size = 5000. LLCI = lower level of the 95% bootstrap percentile confidence interval; ULCI = upper level of the 95% bootstrap percentile confidence interval.

Table 6
Exploratory text analysis.

	Essay Length			Personal Pronouns			Six-Letter Words			Insight Words			Causal Words		
	β	t	p	β	t	p	β	*t*	p	β	t	p	β	*t*	*p*
UV vs. Control Contrast	.03	0.61	.38	.38	9.50	.000	-.23	−4.93	.000	.05	1.20	.230	-.10	−2.04	.042
UV Framing Contrast	-.03	−0.54	.04	.04	0.92	.358	-.03	−0.59	.555	-.01	−0.38	.707	-.08	−1.58	.115
First Exam Grade	.23	4.75	.07	.07	1.60	.111	.28	5.90	.000	.10	2.57	.010	.14	2.85	.005
UV vs. Control x Exam	.08	1.61	.03	.03	0.67	.502	.09	1.87	.062	.04	1.00	.317	.09	1.93	.054
UV Framing x Exam	.11	2.26	.05	.05	1.24	.215	.12	2.67	.008	-.03	−0.66	.509	.08	1.58	.116
FG	.15	3.09	.06	.06	1.53	.126	.11	2.31	.021	.02	0.58	.56	.07	1.36	.176
URM	.08	1.69	.10	.10	2.49	.013	.04	0.86	.389	.03	0.77	.441	.03	0.62	.536
Gender	.06	1.33	.01	.01	0.17	.867	.08	1.68	.093	-.02	−0.63	.528	-.04	−0.85	.396
Course Type	-.09	−1.85	-.47	-.47	−11.51	.000	.02	0.35	.728	-.67	−17.62	.000	-.14	−2.81	.005

Note. $df = 402$. UV vs. Control Contrast (student-framed UV, +1, instructor-framed UV, +1, Control, −2), UV Framing Contrast (student-framed UV, +1, instructor-framed UV, −1, Control, 0), FG = First-generation (FG = +1, Continuing-generation = −1) URM = Underrepresented Minority (URM = +1, Majority = −1), Gender (Female = +1, Male = −1), Course Type (biology = 1, psychology = −1).

wrote as part of the writing assignment to see if there were any hints of threat or disengagement. Given that the results were unexpected, we wanted to understand whether students completed the assignment as intended. Previous research has found that UV writing is characterized by a number of linguistic features that can illuminate the processes underlying UV intervention effects (Beigman Klebanov, Burstein, Harackiewicz, Priniski, & Mulholland, 2017; Priniski et al., in press). For example, Harackiewicz et al. (2016) found that student who benefit from the UV essay become particularly engaged with the assignment, writing longer essays. If students were not engaged with the assignment, this might be one reason that the UV intervention was not helpful for struggling students as in prior research. Therefore, we examined the length of students' essays, as well as other linguistic indicators (e.g., the types of words that students used) in order to determine whether the UV assignments in the current study contained the types of linguistic features that have been associated with the intervention in previous work (see Table 6).

Essay Length. We first assessed essay length (average number of words), as a measure of engagement in the assignment (Harackiewicz et al., 2016), to determine whether struggling students were more likely to disengage from the assignment. There was a significant two-way interaction between the UV Framing contrast and first exam grade on essay length, $\beta = 0.11$, $SE = 0.05$, $p = .024$ (see Fig. 3 and Table 6). Simple slope analyses revealed that for students struggling in the course, the student-framed UV intervention decreased essay length compared to the instructor-framed UV intervention, $t\ (402) = 2.26$, $\beta = 0.15$, $SE = 0.05$, $p = .024$. This is one indication that struggling students became disengaged with the assignment when the UV assignment was framed with student examples.

Essay Content. We examined the content of the essays using LIWC dictionaries (Pennebaker, Booth, Boyd, & Francis, 2015). LIWC contains dictionaries that correspond to different categories of words (e.g., personal pronouns, cognitive mechanisms) and calculates how many words in each of the pre-determined LIWC dictionaries appear in each essay. UV assignments are designed to encourage personal, informal writing. We chose two LIWC dictionaries that tap into students' use of personal and informal writing: personal pronouns (e.g., I, us, your) and longer words (> 6 letters) (Harackiewicz et al., 2016). We hypothesized that the UV assignments would prompt the use of more personal pronouns and shorter words (i.e., simpler words and less technical vocabulary), because the UV assignment requires that students make a personal connection with the material, which often involves the use of more colloquial language. In the control writing assignment, students do not make personal connections and are required to summarize course material, therefore they wouldn't use as many personal pronouns and would likely use more technical language in their essays.

As expected, students in the UV conditions used more personal pronouns, $\beta = 0.38$, $SE = 0.04$, $p < .001$, and fewer long words (> 6 letters), $\beta = -0.23$, $SE = 0.05$, $p < .001$. Struggling students used fewer long words than students performing well in the course, $\beta = 0.28$, $SE = 0.05$, $p < .001$, and this was particularly true in the student-framed UV condition, $\beta = 0.12$, $SE = 0.05$, $p = .008$ (see Fig. 3 and Table 6). Simple slopes revealed that the student-framed UV intervention caused struggling students to use simpler words, compared to the instructor-framed UV intervention, $t\ (402) = 2.67$, $\beta = 0.12$, $SE = 0.07$, $p = .008$.

In addition to writing more informally, the UV assignments are expected to deepen students' cognitive processing (Harackiewicz et al., 2016). The UV assignment provides an avenue for students to make connections between themselves and the course material, which encourages a deeper understanding of the material. Previous research found that students writing UV essays use more words indicative of cognitive processing (e.g., words associated with causal processes; words associated with encoding information, etc.) (Harackiewicz et al., 2016; Priniski et al., in press). We selected two dictionaries related to cognitive involvement: insight words (e.g. consider, idea, understand) and causal words (e.g. because, effect, hence). The insight dictionary assesses active learning, encoding, and understanding, and the causal dictionary connotes attempts to explain causes and effects, indicators of deeper processing.

In contrast to previous work (Harackiewicz et al., 2016), students in the UV conditions used fewer causal words, on average, than students in the control condition, $\beta = -0.10$, $SE = 0.05$, $p = .042$. This main effect was qualified by the interaction with first exam grade, $\beta = 0.09$, $SE = 0.05$, $p = .054$. The UV interventions caused struggling students in particular to use fewer causal words, $t\ (402) = 1.93$, $\beta = -0.13$, $SE = 0.05$, $p = .054$, compared to the control (see Fig. 3). In addition, the UV intervention did not affect the use of insight words, $\beta = 0.05$, $SE = 0.04$, $p = .23$. These analyses suggest that students in the UV conditions were not using language indicative of cognitive processing more than students in the control condition.

4. Discussion

The results of this study were surprising, because the UV intervention did not help struggling students as previous research has shown. Contrary to our hypotheses, we found that struggling students became less interested and perceived less UV overall in UV conditions, compared to the control. Even though all students, on average, were articulating more UV and writing more informally in the UV conditions, as intended, struggling students did not benefit from this type of writing. In fact, the UV interventions caused these students to doubt their preparedness for the class, lose confidence about their performance, and care less about doing well, which contributed to decreased interest and perceived UV at the end of the course. Clearly, the UV intervention did not have its desired effects in this context. The UV

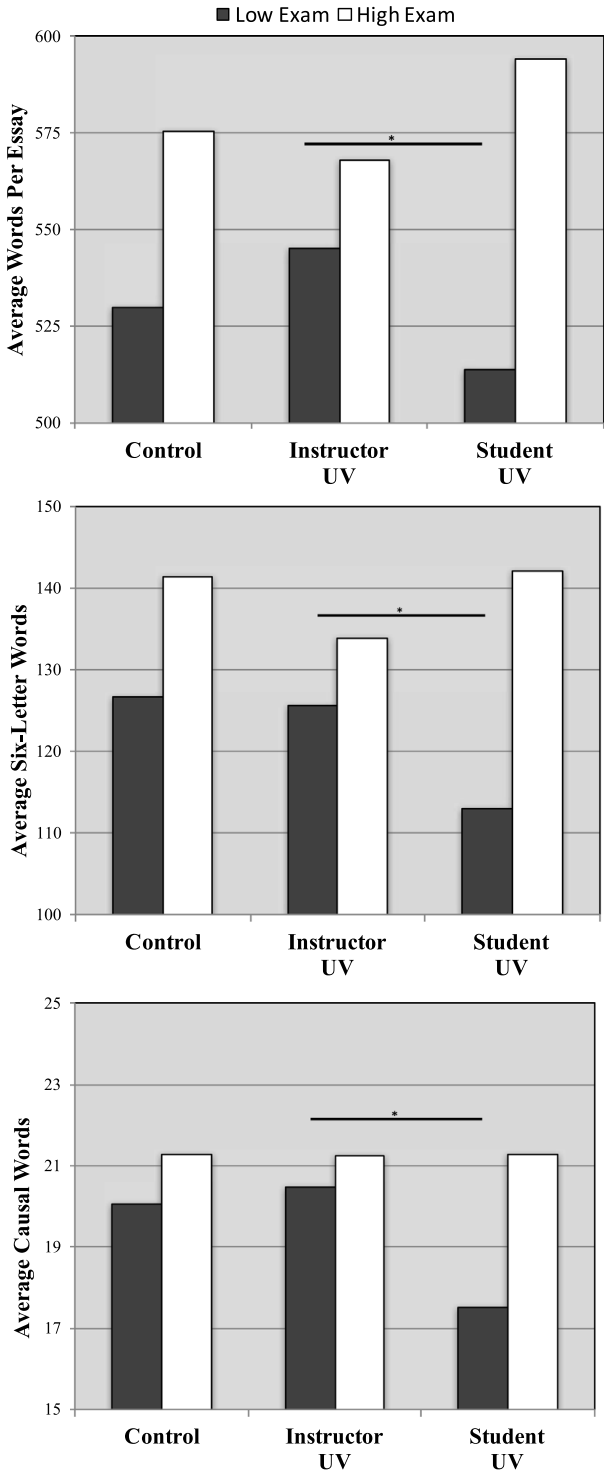

Fig. 3. Average words per essay, six-letter words, and causal words as a function of treatment condition and first exam grade. Predicted values are computed from the mean of exam grade (low = −1 SD, high = +1 SD).

interventions may have been somewhat threatening for students who were already struggling to keep up with the material. Making personal connections with the course material may have been motivating for students doing well in the course, but may have been threatening for students who had not yet mastered the material.

We found that the framing of the UV examples had a polarizing effect for students. High-performing students benefitted the most in terms of interest and perceptions of UV when UV examples were framed from former students in the course, rather than from the instructor. We had originally hypothesized that this type of UV assignment would be more effective for students, and particularly so for struggling students, but instead, it proved most effective for students who were doing well in the course. This framing may have reinforced the importance of competence for these confident students. That is, when other students articulated that the course material was meaningful and useful, mastering the material became particularly important. In contrast, the same UV examples had a negative effect on grades for students struggling in the course. These students disengaged from the assignment (i.e., wrote shorter essays) and reported that they cared less about doing well in the course after receiving utility-value information from former students. Messages from other students about the importance of course material may create feelings of pressure for individuals who are unsure if they can master the material, causing them to worry, become disengaged, and perform more poorly. Learning that another student could articulate value might actually accentuate their own perceived inability to do so, and thus undermine confidence.

We hypothesized that the student-framed UV intervention in particular would encourage students to find more UV in their assignments and write more informally. The student-framed UV prompt did have the intended effect on writing: students performing poorly in the course articulated more UV, wrote more informally, and used simpler words in the student-framed UV condition. However, these students did not benefit from articulating more UV in their essays; instead, they perceived the course material as less useful and relevant in UV conditions. In other words, articulating UV in one topic (i.e., the chosen topic of their essay) did not lead to more perceived UV for the broader topic of psychology or biology at the end of the course.

4.1. Why were the utility-value interventions detrimental for low performers?

Previous research has found that UV interventions work best for students who doubt their competence and for those with a history of poor performance (Harackiewicz et al., 2016; Hulleman et al., 2010; Hulleman & Harackiewicz, 2009). Therefore, it was surprising that in this study we found a negative effect of the UV interventions for low performers. We hypothesize that low performers may not have processed the course content enough to benefit from the UV intervention. Our analysis of the essay content suggests that students in UV conditions may not have synthesized the material as much as students in the control. Previous work showed that UV assignments contain more language indicative of cognitive processing than control assignments (Harackiewicz et al., 2016), but that was not the case in this sample. In fact, students used fewer causal words in the UV conditions, compared to the control, especially among low-performing students. This suggests a lack of content synthesis and deep processing, which is one possible explanation for why these students did not benefit from the UV intervention in this study, as previous research has found (Harackiewicz et al., 2016; Hulleman & Harackiewicz, 2009).

Expectancy-value theory hypothesizes that task values have the most influence on attitudes and behavior when perceived competence is high (Eccles & Wigfield, 2002). For students who lack confidence, perceiving higher utility value could be threatening, yielding negative consequences, such as greater procrastination, lower interest, and higher test stress (Canning & Harackiewicz, 2015; Lee, Bong, & Kim, 2014; Lee, Lee, & Bong, 2013). Because students were not synthesizing the course material at a deeper level, it is possible that students struggling in the course lacked the confidence/competence piece of the expectancy-value model. In fact, we found that the UV interventions actually decreased confidence for low performers and made them question their preparedness. Previous studies have shown that building confidence may be a by-product of the UV intervention (Canning & Harackiewicz, 2015; Hulleman et al., 2017). Without the confidence gained from mastering the course material, the students in this study

may not have been able to benefit from finding UV.

Another possibility is that the UV interventions may have had an ironic back-firing effect due to the difficulty (vs. ease) of retrieving UV examples (Schwarz et al., 1991; Walton & Cohen, 2007). The UV instructions make it clear to students that they should be able to make meaningful connections between the course topics and their lives. This could signal to students who have trouble generating UV examples, that they, in fact, do not perceive UV in the topic, exacerbating the problem. Indeed, laboratory research has found that asking students to list many (vs. few) UV connections increased perceived task difficulty, which was associated with lower levels of perceived utility value (Lindeman, Durik, & Hall, 2018). In the current study, we found that the UV interventions decreased perceived UV overall for struggling students by the end of the course. Perhaps struggling students had more difficulty generating UV examples and thus perceived less UV as a result. The difficulty and ease of retrieving UV examples should be explored with different samples in future research.

4.2. Implications for framing utility-value interventions

Our research suggests that the effects of UV interventions are more variable than originally thought. Providing examples with UV interventions can be tricky because there is increasing evidence that directly-communicated UV information can be threatening for students who lack confidence in their ability to do well (Canning & Harackiewicz, 2015; Durik et al., 2015a,b; Durik & Harackiewicz, 2007; Durik, Hulleman, et al., 2015). However, providing examples can actually boost the effectiveness of the UV intervention when implemented without threat (Canning & Harackiewicz, 2015). Therefore, more research is needed to understand how to reduce the threat of this type of instructional support.

In this study, we sought to offset the negative effects of directly-communicated UV information by framing the information in the form of student quotes; however this had the unintended consequence of making UV information even more threatening for students who were performing poorly in the course. It might be that students were comparing themselves to the students who ostensibly wrote the UV examples. The student-framed UV examples were written without any grammatical errors and contained language similar to the instructor-framed UV examples; therefore, it is likely that students believed that the author of the examples was a high-achieving student. Indeed, comparisons with high-achieving peers can lead to lower academic self-competence (Altermatt & Pomerantz, 2005; Marsh, 1987). For struggling students, the student-framed UV examples may be yet another signal that they lack adequate skills to do well in the course. In contrast, high-achieving students might believe they perform better than or equal to other students and so the student-framed UV examples may not be as threatening. In fact, we found that the student-framed UV examples were actually beneficial for students performing well in the course.

4.3. Limitations and future directions

One limitation of this study is that we cannot be sure that the negative effects we found are specific to the 2-year college context or whether these effects might be due to students' level of writing competency. For instance, many of the students in the current sample did not have very much experience with college-level writing and this inexperience might explain the negative effects of the intervention. It is possible that the UV intervention might have positive effects in the 2-year context if it were implemented after students had a chance to more fully develop their writing skills or if it were implemented alongside instructional supports targeted specifically for the writing process, rather than support for generating UV. Given that the sample characteristics of this study were fairly similar to other U.S. 2-Year colleges, we would expect other students in 2-year colleges to have similar challenges with college-level writing assignments. Future research should consider literacy and writing skills as critical moderators of UV intervention effects.

Another limitation of this study is that we did not measure students' threat responses directly. Given that the results were unexpected, we did not anticipate needing to measure students' responses of threat to the intervention. Instead, we had to investigate threat and other negative reactions to the UV intervention indirectly by examining students' attitudes about the course (i.e., perceived preparedness, confidence about performance, competence valuation, perceptions of course difficulty, and belonging uncertainty). Future research should consider measuring backfiring effects and include measures of threat directly after the intervention as a potential mechanism.

While the effect sizes in this study are relatively small in magnitude by conventional benchmarks, the practical effect on students' performance and psychological experience is large when taking into account the brevity of the intervention (for guidelines of interpreting effect sizes of educational interventions, see Kraft, 2019; Lazowski & Hulleman, 2016). Even a small decrease in GPA could mean the difference between receiving credit for the course, retaining financial aid, and/or degree completion from the students' perspective. Furthermore, given the minimal differences between the two intervention conditions, it is not surprising that the effect size of UV framing is fairly small; though, even small effects are important for understanding students' reactions to the nuanced differences between the framing of an intervention. This underscores the critical importance of testing variations in intervention implementation in order for these techniques to be adaptable for different educational contexts.

Despite finding negative effects of the UV intervention, we can glean important lessons about implementing UV interventions from this study. First, and most critical from both a theoretical and practical perspective, students struggling in introductory courses may need to build confidence by demonstrating their competence before they can benefit from UV. Future studies should attend to how much course content students are synthesizing in their essays and confidence should be measured as a process variable to determine if the intervention is working as intended. Second, until it is clear how to present UV information in a non-threatening manner, UV examples may be too threatening to implement with struggling students. Finally, UV interventions are not a one-size-fits-all approach for motivating students. UV interventions should be tailored for the context and designed to complement current instructional practices (e.g., writing composition). These insights were made possible by testing the UV intervention in a different educational context than the 4-year institutions in which much research is conducted. Thus, if we wish to help students struggling in introductory courses, it is imperative to expand our current understanding of the contextual effects of intervention science.

Acknowledgements

This research is based on the doctoral dissertation of Elizabeth Canning. We thank Elizabeth's dissertation committee members (Janet Hyde, Patricia Devine, Markus Brauer, and Sara Goldrick-Rab) for their feedback on earlier drafts of this manuscript. This research was supported by the Wisconsin HOPE Lab. We especially thank Sara Goldrick-Rab, Alison Bowman, Jilana Boston, and Cameron Hecht for their time and dedication with this project. Stacy Priniski and Elizabeth Canning were supported by grants from the Institute of Educational Sciences, U.S. Department of Education, through Award #R305B090009 and R305B150003 to the University of Wisconsin-Madison. Elizabeth Canning was supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. DGE-1256259. Stacy Priniski was supported by a National Academy of Education/Spencer Dissertation Fellowship. The opinions expressed are those of the authors and do not represent the views of the U.S. Department of Education, the National Science Foundation, the National Academic of

Education, or the Spencer Foundation.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.learninstruc.2019.05.001.

References

Altermatt, E. R., & Pomerantz, E. M. (2005). The implication of having high-achieving versus low-achieving friends: A longitudinal analysis. *Social Development, 14*, 61–81.

Bailey, T. R., Jenkins, D., & Leinbach, T. (2005). *What we know about community college low-income and minority student outcomes: Descriptive statistics from national surveys.* New York, NY: Columbia University, Teachers College, Community College Research Center.

Bailey, T. R., Jeong, D. W., & Cho, S. W. (2010). Referral, enrollment, and completion in developmental education sequences in community colleges. *Economics of Education Review, 29*, 255–270.

Beigman Klebanov, B., Burstein, J., Harackiewicz, J., Priniski, S. J., & Mulholland, M. (2017). Reflective writing about the utility value of science as a tool for increasing STEM motivation and retention: Can AI help scale up? *International Journal of Artificial Intelligence in Education, 27*, 791–818.

Berndt, T., Laychak, A. E., & Park, K. (1990). Friends' influence on adolescents' academic achievement motivation: An experimental study. *Journal of Educational Psychology, 82*, 664–670.

Bickerstaff, S., Barragan, M., & Rucks-Ahidiana, Z. (2012). *"I came in unsure of everything": Community college students' shifts in confidence.* New York, NY: Columbia University, Teachers College, Community College Research Center.

Canning, E. A., & Harackiewicz, J. M. (2015). Teach it, don't preach it: Testing the difference between directly-communicated and self-generated utility value information. *Motivation Science, 1*, 47–71.

Canning, E. A., Harackiewicz, J. M., Priniski, S. J., Hecht, C. A., Tibbetts, Y., & Hyde, J. S. (2018). Improving performance and retention in introductory biology with a utility value intervention. *Journal of Educational Psychology, 110*(6), 834–849.

Cox, R. D. (2009). "It was just that I was afraid" Promoting success by addressing students' fear of failure. *Community College Review, 37*, 52–80.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior.* New York: Plenum.

Durik, A. M., & Harackiewicz, J. M. (2007). Different strokes for different folks: How personal interest moderates the effects of situational factors on task interest. *Journal of Educational Psychology, 99*, 597–610.

Durik, A. M., Hulleman, C. S., & Harackiewicz, J. M. (2015a). One size fits some: Instructional enhancements to promote interest don't work the same for everyone. In K. A. Renninger, M. Nieswandt, & S. Hidi (Eds.). *Interest and K-16 mathematics and science learning, in and out of school.* Washington, DC: American Educational Research Association.

Durik, A. M., Shechter, O. G., Noh, M., Rozek, C. S., & Harackiewicz, J. M. (2015b). What if I can't? Success expectancies moderate the effects of utility value information on situational interest and performance. *Motivation and Emotion, 39*, 104–118.

Eccles, J. S. (2009). Who am I and what am I going to do with my life? Personal and collective identities as motivators of action. *Educational Psychologist, 44*, 78–89.

Eccles, J. S., Adler, T. F., Futterman, R., Geoff, S. B., Kaczala, C. M., Meece, J. L., et al. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.). *Achievement and achievement motivation* (pp. 75–146). San Francisco, CA: W.H. Freeman.

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*, 109–132.

Gallimore, R., & Tharp, R. (1990). Teaching mind in society: Teaching, schooling, and literate discourse. In L. C. Moll (Ed.). *Vygotsky and education: Instructional implications and application of sociohistorical psychology* (pp. 175–205). Cambridge, UK: Cambridge University Press.

Gaspard, H., Dicke, A.-L., Flunger, B., Brisson, B. M., Häfner, I., Nagengast, B., et al. (2015). Fostering adolescents' value beliefs for mathematics with a relevance intervention in the classroom. *Developmental Psychology, 51*(9), 1226–1240. https://doi.org/10.1037/dev0000028.

Greenwood, C. R., Delquadri, J., & Hall, R. V. (1989). Longitudinal effects of classwide peer tutoring. *Journal of Educational Psychology, 81*, 371–383.

Harackiewicz, J. M., Canning, E. A., Tibbetts, Y., Giffen, C. J., Blair, S. S., Rouse, D. I., et al. (2014). Closing the social class achievement gap for first-generation students in undergraduate biology. *Journal of Educational Psychology, 106*, 375–389.

Harackiewicz, J. M., Canning, E. A., Tibbetts, Y., Priniski, S. J., & Hyde, J. S. (2016). Closing achievement gaps with a utility-value intervention: Disentangling race and social class. *Journal of Personality and Social Psychology, 111*(5), 745–765.

Harackiewicz, J. M., Durik, A. M., Barron, K. E., Linnenbrink-Garcia, L., & Tauer, J. M. (2008). The role of achievement goals in the development of interest: Reciprocal relations between achievement goals, interest, and performance. *Journal of Educational Psychology, 100*, 105–122.

Harackiewicz, J. M., & Sansone, C. (1991). Goals and intrinsic motivation: You can get there from here. *Advances in Motivation and Achievement, 7*, 21–49.

Harackiewicz, J. M., Tibbetts, Y., Canning, E. A., & Hyde, J. S. (2014). Harnessing values to promote motivation in education. In S. Karabenick, & T. Urden (Vol. Eds.), *Motivational interventions, advances in motivation and achievement: Vol. 18*, (pp. 71–105). Bingley, UK: Emerald Group Publishing.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* New York, NY: Guilford Press.

Hidi, S., & Harackiewicz, J. M. (2000). Motivating the academically unmotivated: A critical issue for the 21st century. *Review of Educational Research, 70*, 151–179.

Horn, L., & Nevill, S. (2006). *Profile of undergraduates in U.S. postsecondary education institutions: 2003-04 with a special analysis of community college students. NCES 2006-184.* Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Hulleman, C. S., Durik, A. M., Schweigert, S., & Harackiewicz, J. M. (2008). Task values, achievement goals, and interest: An Integrative analysis. *Journal of Educational Psychology, 100*, 398–416.

Hulleman, C. S., Godes, O., Hendricks, B. L., & Harackiewicz, J. M. (2010). Enhancing interest and performance with a utility value intervention. *Journal of Educational Psychology, 102*, 880–895.

Hulleman, C. S., & Harackiewicz, J. M. (2009). Promoting interest and performance in high school science classes. *Science, 326*, 1410–1412.

Hulleman, C. S., Kosovich, J. J., Barron, K. E., & Daniel, D. B. (2017). Making connections: Replicating and extending the utility value intervention in the classroom. *Journal of Educational Psychology, 109*, 387–404.

King, A., Staffieri, A., & Adelgais, A. (1998). Mutual peer-tutoring: Effects of structuring tutorial interaction to scaffold peer learning. *Journal of Educational Psychology, 90*, 134–152.

Kraft, M. A. (2019). Interpreting effect sizes of educational interventions. Retrieved from https://scholar.harvard.edu/mkraft/publications/interpreting-effect-sizes-education-interventions .

Lazowski, R. A., & Hulleman, C. S. (2016). Motivation interventions in education: A meta-analytic review. *Review of Educational Research, 86*, 602–640.

Lee, J., Bong, M., & Kim, S. (2014). Interaction between task values and self-efficacy on maladaptive achievement strategy use. *Educational Psychology, 34*, 538–560. https://doi.org/10.1080/01443410.2014.895296.

Lee, J., Lee, M., & Bong, M. (2013). High value with low perceived competence as an amplifier of self- worth threat. In D. McInerney, H. Marsh, R. Craven, & F. Guay (Eds.). *Theory driving research: New wave perspectives on self-processes and human development* (pp. 205–231). Charlotte, NC: Information Age.

Lindeman, M. I. H., Durik, A. M., & Hall, G. J. (2018). Sometimes less is more: The role of subjective task experience in self-generated value interventions. *Social Psychology of Education, 21*, 371–381. https://doi.org/10.1007/s11218-017-9417-7.

Linnenbrink-Garcia, L., Durik, A. M., Conley, A. M., Barron, K. E., Tauer, J. M., Karabenick, S. A., et al. (2010). Measuring situational interest in academic domains. *Educational and Psychological Measurement, 70*, 647–671.

Marsh, H. W. (1987). The big-fish-little-pond effect on academic self-concept. *Journal of Educational Psychology, 79*, 280–295.

McNeill, K. L., Lizotte, D. J., Krajcik, J., & Marx, R. W. (2006). Supporting students' construction of scientific explanations by fading scaffolds in instructional materials. *The Journal of the Learning Sciences, 15*, 153–191.

Pennebaker, J. W., Booth, R. J., Boyd, R. L., & Francis, M. E. (2015). *Linguistic inquiry and word count: LIWC2015.* Austin, TX: Pennebaker Conglomerates. www.LIWC.net.

Perin, D. (2013). Literacy skills among academically underprepared students. *Community College Review, 41*, 118–136.

Perin, D., Keselman, A., & Monopoli, M. (2003). The academic writing of community college remedial students: Text and learner variables. *Higher Education, 45*, 19–42.

Priniski, S. J., Rosenzweig, E. Q., Canning, E. A., Hecht, C. A., Tibbetts, Y., Hyde, J. S., et al (in press). The benefits of combining value for the self and others in utility-value interventions. Journal of Educational Psychology.

Puntambekar, S., & Kolodner, J. L. (2005). Toward implementing distributed scaffolding: Helping students learn science from design. *The Journal of the Learning Sciences, 42*, 185–217.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Renninger, K. A., & Hidi, S. (2011). Revisiting the conceptualization, measurement, and generation of interest. *Educational Psychologist, 46*, 168–184.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context.* Oxford, UK: Oxford University Press.

Rosenzweig, E. Q., Harackiewicz, J. M., Priniski, S. J., Hecht, C. A., Canning, E. A., Tibbetts, Y., et al. (2018). *Choose your own intervention: Using choice to enhance the effectiveness of a utility-value intervention. Motivation Science.* Advance online publication.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys.* New York, NY: Wiley.

Ryan, A. M. (2000). Peer group as a context for the socialization of adolescents' motivation, engagement, and achievement in school. *Educational Psychologist, 35*, 101–111.

Ryan, A. M. (2011). Peer relationships and academic adjustment during early adolescence. *The Journal of Early Adolescence, 31*, 5–12.

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization. *Journal of Personality and Social Psychology, 57*, 749–761.

Schwarz, N., Bless, H., Strack, F., Klumpp, G., Rittenauer-Schatka, H., & Simons, A. (1991). Ease of retrieval as information: Another look at the availability heuristic. *Journal of Personality and Social Psychology, 61*, 195–202.

Shin, T. S., Ranellucci, J., & Roseth, C. J. (2017). Effects of peer and instructor rationales on online students' motivation and achievement. *International Journal of Educational Research, 82*, 184–199.

Thoman, D. B., Muragishi, G. A., & Smith, J. L. (2017). Research microcultures as socialization contexts for underrepresented science students. *Psychological Science, 28*, 760–773.

Thoman, D. B., Sansone, C., Fraughton, T., & Pasupathi, M. (2012). How students socially evaluate interest: Peer responsiveness influences evaluation and maintenance of interest. *Contemporary Educational Psychology, 37*, 254–265.

Vygotsky, L. S. (1978). *Mind and society: The development of higher mental processes.* Cambridge, MA: Harvard University Press.

Walton, G. M., & Cohen, G. L. (2007). A question of belonging: Race, social fit, and achievement. *Journal of Personality and Social Psychology, 92*, 82–96.

Wang, M.-T. (2012). Educational and career interests in math: A longitudinal examination of the links between classroom environment, motivational beliefs, and interests. *Developmental Psychology, 48*, 1643–1657.