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Changes in Undergraduate Students' Self-Efficacy and Outcome Expectancy in an Introductory Statistics Course

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The exploration of psychological variables that potentially impact college student performance in challenging academic courses can be useful for understanding success in introductory statistics. Although previous research has examined specific beliefs that students hold about their abilities and future outcomes, the current study is novel in its examination of changes in both self-efficacy (SE) and outcome expectancy (OE) in relation to performance over the course of an undergraduate introductory psychology statistics course. These psychological variables—relating to one's belief about one's ability to accomplish a task and the anticipated outcomes—may impact student motivation and performance. Students' SE, OE, and other variables related to statistics performance were measured through a survey administered at the beginning and end of the course. Multivariate logistic regression and McNemar tests were conducted to examine factors that affected changes in SE and OE as the semester progressed. Students with lower scores on the final exam demonstrated a decrease in both high SE and positive OE. However, higher scores on exams earlier in the course were associated with increased odds for high SE but not for positive OE, suggesting that SE is less resilient to course performance. Based on these findings, the authors recommend that statistics instructors identify students at risk for decreasing SE. Instructors can help foster high SE in students struggling academically by connecting the course content to their everyday lives and suggesting strategies to enhance their confidence in their content knowledge and increase their comfort in navigating such a challenging course.

Keywords: statistics education, research, self-efficacy, outcome expectancy, statistics

Statistics is a mathematics-based course required by many undergraduate degree programs (Norcross et al., 2016). A statistics course is fundamental for students because it fosters critical thinking and reasoning skills (Cheng et al., 2018; Vanhoof et al., 2011; Wilson, 2013). Students of statistics courses become informed consumers of knowledge (Barber, 2002), and are equipped with the ability to evaluate and conduct analyses of research. As society's reliance on complex data increases, the ability to analyze large sets of data and apply statistical skills and techniques is required for those entering the workforce (Brown & Kass, 2009). As a result, enrollment in statistics courses from 2010-2015 increased by 19% (Blair et al., 2018) and employment opportunities for statisticians are projected to grow by 30% from 2018 to 2028, outpacing the rate of many other professions (The Bureau of Labor Statistics, 2020). Given that statistics courses carry such weight for students' academic trajectory and their eventual entry into the workforce, research devoted to variables affecting academic performance in undergraduate introductory statistics courses has received much attention.

Diverse student characteristics and behaviors have been researched in relation to statistics course performance. Studies focusing on the relationship between sex and statistics courses report that females hold more negative perceptions about statistics (Cendales et al., 2013; Zimprich, 2012) and that statistics anxiety may manifest differently in females compared to males. For example, procrastination—the tendency to delay initiation of academic tasks—and poorer learning strategies, such as memorization, were found more likely to lead to statistics anxiety in men (Rodarte-Luna & Sherry, 2008). Students with more experience and past achievements in statistics or related fields (e.g., mathematics) have higher achievement in statistics courses (Johnson & Kuennen, 2006; Ramirez et al., 2012). Academic procrastination (Schraw et al., 2007), is negatively correlated with statistics engagement (Onwuegbuzie, 2004) and academic performance (Goroshit, 2018; Paechter et al., 2017; Rodarte-Luna & Sherry, 2008; Wang & Englander, 2010). Research on help-seeking behavior, the tendency to seek academic assistance (Newman, 2002), shows that the absence of help-seeking behavior may be related to predictors leading to lower statistics performance (Rodarte-Luna & Sherry, 2008).

Psychological factors such as motivation, student beliefs, attitudes, and emotions are particularly important as they can impact academic performance in statistics courses. Undergraduate students who were motivated had better exam grades and valued statistics more than those not motivated (Budé et al., 2007). Students' beliefs and attitudes about their knowledge of statistics do not solely impact their course performance (Chiesi & Primi, 2009; Dempster & McCorry, 2009; Ramirez et al., 2012), but can also disrupt learning and application of statistical concepts outside of the classroom (Gal & Ginsberg, 1994). Even in classes utilizing diverse teaching styles (e.g., lecture-based versus active learning), ambivalent attitudes toward statistics remain fairly stable throughout the semester (Bateiha et al., 2020). Finally, some emotional states such as fear (Slootmaeckers et al., 2014) and anxiety (Cui et al., 2019; Davis & Mirick, 2015; Esnard et al., 2021; Trassi et al., 2022) towards statistics negatively affect student academic performance in statistics. These emotional states impact cognitive factors, which ultimately alter students' expectations of statistics courses, effort exerted, and academic performance. Specific cognitive variables and their positive relationship to academic performance in statistics including self-regulation (Acee & Weinstein, 2010; Dunn, 2014), the use of cognitive and meta-cognitive strategies (Rodarte-Luna & Sherry, 2008; Trogden & Royal, 2019), and analytical skills (Miller, 2019) have been investigated. Among these cognitive variables, one of particular importance is students' self-efficacy in statistics.

Self-efficacy is defined as an individual's perceived ability to accomplish a designated task (Bandura, 1977) and is believed to be domain-specific (Bandura, 1997; Pajares, 2009). Self-efficacy as a predictor of academic success in statistics has yielded conflicting findings. While most studies (Finney & Schraw, 2003; Mantooth et al., 2020; McGrath et al., 2015) report high self-efficacy change to be a strong predictor of academic success in statistics, other studies failed to find a significant association between increased self-efficacy and success in statistics (Mihai-Bogdan et al., 2015; Olani et al., 2011; Walker & Brakke, 2017). In one study, student self-efficacy for statistics increased as the semester progressed (Walker & Brakke, 2017). However, self-efficacy alone does not contribute to achievement in a statistics course (Franceschini et al., 2014).

Outcome expectancy refers to beliefs about anticipated outcomes of action (Bandura, 1986; 1997); these expectancies are mechanisms thought to influence performance and behavior (Bandura, 1986). Self-efficacy is also positively associated with outcome expectancy (Williams, 2010). Many studies exploring outcome expectancy focus on risky behavior such as smoking (Glock et al., 2012; Pokhrel et al., 2014; Urbán, 2010), drinking (Lopez-Vergara et al., 2012; Read, 2012), safe sex (Newby et al., 2013), and gambling (St-Pierre et al., 2013). One study focusing on academic aspects of outcome expectancy found that increasing high self-efficacy and outcome expectancy in low-performing students improved undergraduate students' English course performance (Elborolosy & Al Thenyan, 2020). Another study on high school students enrolled in science and engineering-technology courses reported that students' self-efficacy and outcome expectancy directly impacted their course performance (Han et al., 2021). Notably, student course performance was also impacted by the teachers' self-efficacy and outcome expectancy regarding their own teaching ability—suggesting that student performance in other Science, Technology, Engineering, and Mathematics (STEM) courses, such as statistics, could also be enhanced by improving their confidence in their own ability and outcome expectation related to those courses. Another study found that Chinese elementary school students' increased STEM stereotype beliefs negatively predicted their STEM self-efficacy and positive outcome expectancy. Additionally, their STEM self-efficacy and positive outcome expectancy predicted their STEM career interest (Luo et al., 2021).

Three studies have focused on outcome expectancy concerning statistics courses, although they did not study change in outcome expectancy. In one study, outcome expectancy was influenced by perceived controllability and perhaps unsurprisingly, negative outcome expectancy had a negative association with effect on first-year students enrolled in a health sciences statistics course (Budé et al., 2007). In another study, significant predictors of achievement in a psychology statistics course were past academic performance in statistics and positive expectancy (Hood et al., 2012). Finally, self-efficacy has been found to directly affect expectations for performance in statistics (Esnard et al., 2021). Further understanding the association of change in outcome expectancy with other variables and statistics course performance is warranted.

While numerous studies focus on self-efficacy in relation to undergraduate introductory statistics courses, few focus on outcome expectancy about this course, and the authors are not aware of any study that focuses on both psychological constructs. Therefore, the current study tracks changes in undergraduate students' academic self-efficacy and outcome expectancy while enrolled in an undergraduate introductory psychology statistics course. We study how these constructs change according to students' academic performance over the course of an academic semester. We include other relevant variables shown to impact academic performance in a statistics course of sex, college year, help-seeking behavior, and academic procrastination as covariates. We predict that students' outcome expectancy will be more resilient to change than their self-efficacy based on their performance in a statistics course and associated covariates. We predict that self-efficacy will change more than outcome expectancy, due to self-efficacy previously being associated with course performance (Hii et al., 2013; McGrath et al., 2015; Waples, 2016). If our prediction is accurate, these results will support the conclusion that self-efficacy and outcome expectancy are not uniformly affected throughout a statistics course, in which students can begin the course with many preconceived fears and anxiety about the topic (Cui et al., 2019; Davis & Mirick, 2015; Esnard et al., 2021; Slootmaeckers et al., 2014). As such, the use of different interventions to address these constructs in students enrolled in statistics courses would be warranted.

Methods

Participants

Participants were undergraduate students enrolled in introductory psychology statistics courses at an urban public college that is part of a large public university system in the Northeast United States. All students who attended class during the first week of the semester were invited to participate. The study was conducted in three introductory psychology statistics course sections, each from a different academic semester. Participation entailed completion of study pre- and post-questionnaires at week 1 (beginning) and week 15 (end) of the semesters. Participants were not compensated nor were they penalized for non-participation. There were 341 students initially enrolled, and 286 students participated for an 83.9% response rate. The study was ethically conducted and received IRB approval. All participants provided informed consent.

Procedure

The course instructor and two research assistants created the self-report questionnaire used in the current study, which inquired about student demographics, academic self-efficacy, academic outcome expectancy, academic help-seeking behavior, and academic procrastination.

Psychological Measurements

Academic self-efficacy was assessed by self-report response to the statement, "I am [was] quite capable of mastering the material in this class." Academic outcome expectancy was assessed by self-report response to the statement, "I will [would] never [be able to] do well in this class" where disagreeing indicates positive outcome expectancy. The past tense of the verb [words included in brackets] was used for the follow-up questionnaire. Both statements utilized a 4-point Likert-type scale with response options of 1 = strongly agree, 2 = somewhat agree, 3= somewhat disagree, and 4 = strongly disagree.

The self-efficacy item used in this study was influenced by the statistics self-efficacy assessment developed by Hall and Vance (2010), for which they reported a reliability coefficient of 0.92. The statistics self-efficacy item used in this study was inspired by the question in their assessment "How confident are you with solving statistical problems?". To reduce the time and effort for students to respond to the entire survey used in this study, the full statistics self-efficacy assessment by Hall and Vance (2010) was not adapted. Additionally, the number of scale responses for the adapted self-efficacy item was changed from five to four so the response valence would not be obscured by a neutral answer option.

The outcome expectancy item used in this study was adapted from the statistics outcome expectancy assessment created by Hood et al. (2012). Their assessment question, "I expect to do well in this research methods and statistics course", inspired the outcome expectancy item included in this study. To reduce the time and effort for students to respond to the entire survey used in this study, the full statistics outcome expectancy assessment by Hood et al. (2012) was not adapted. The response scale for the adapted outcome expectancy item was reduced from a 7-point to a 4-point response scale to match the self-efficacy item. Hood et al. (2012) reported a Cronbach's alpha of 0.69 for their outcome expectancy assessment.

Variability in participants' responses to the academic self-efficacy and outcome expectancy scales was low. For the self-efficacy scale given at the beginning of the course, 28.3% of participants selected "strongly agree," 64.7% of participants selected "somewhat agree," 6.6% of participants selected "somewhat disagree," and 0.3% of participants selected "strongly disagree." For the self-efficacy scale given at the end of the course, 23.1% of participants selected "strongly agree," 53.8% of participants selected "somewhat agree," 19.6% of participants selected "somewhat disagree," and 3.5% of participants "strongly disagree." For the outcome expectancy scale given at the beginning of the course, 1% of participants selected "strongly agree," 3.5% of participants selected "somewhat agree," 33.9% of participants selected "somewhat disagree," and 61.5% of participants "strongly disagree." For the outcome expectancy scale given at the end of the course, 2.1% of participants selected "strongly agree," 15.4% of participants selected "somewhat agree," 35.7% of participants selected "somewhat disagree," and 46.9% of participants "strongly disagree." Due to this limited variability, responses for both scales were categorized into agree or disagree.

Help-seeking behavior was assessed by self-report responses to the following two questions on the pre-and post-questionnaire: "If you did not understand something in class or got stuck when working on problems outside of class, how likely were you to: (1) Attend a peer tutor session; and (2) Go to the learning center." Both statements utilized a 4-point Likert-type scale with response options of 1 = very likely, 2 = somewhat likely, 3 = somewhat unlikely, and 4 = never would. Due to the limited variability, responses for those who responded positively to either question (i.e., very likely or somewhat likely) were categorized as self-reported help-seekers while those who endorsed negative responses (i.e., somewhat unlikely or never would) were categorized as non-help-seekers. Kuder-Richardson 20 for the baseline questionnaire was 0.78 and for the follow-up questionnaire was 0.73.

Academic procrastination was assessed by self-report responses to the following four questions on the pre-and post-questionnaire: With regard to academic tasks (e.g., reading for class, completing homework assignments, preparing for exams): (1) To what degree did you tend to delay or procrastinate?; (2) To what degree did you typically have to rush to complete a class-related task on time?; (3) How often did you begin assignments shortly after they are assigned? (reverse coded); and (4) To what degree was procrastination on academic tasks a problem for you? All statements utilized a 5-point Likert-type scale with response options of: Item 1: 1 = never procrastinate, 2 = almost never, 3 = sometimes, 4 = nearly always, and 5= always procrastinate; Item 2: 1 = never rush, 2 = almost never, 3 = sometimes, 4 = nearly always, 5 = always rush; Item 3: 1 = never begin shortly after they are assigned, 2 = almost never, 3 = sometimes, 4 = nearly always, 5 = always begin shortly after they are assigned; and Item 4: 1 = not at all a problem, 2 = a small problem, 3 = a moderate problem, 4 = a large problem, and 5 = a very large problem. Scores on the four items were summed to create a total academic procrastination score, with higher scores indicating a greater tendency to procrastinate. Cronbach alpha for the baseline questionnaire was 0.79 and for the follow-up questionnaire was 0.82.

Course Performance Measurements

Students attended bi-weekly lectures taught by an instructor for 75 minutes per lecture and weekly laboratory sessions led by graduate student instructors for 110 minutes per session. During lecture, the instructor taught students how to use and compute various types of analyses. Each of the three exams, administered during the lecture portion of the class, was semi-cumulative, covered approximately one-third of the course material, and was graded out of 100 possible points. The first examination consisted of multiple-choice questions that tested descriptive statistics, *z*-scores, correlation, regression, fundamentals of the normal curve, and basic probability theory. The second examination consisted of multiple-choice questions and one hypothesis testing procedure (i.e., complete a *t*-test by hand) on the principles and steps of hypothesis testing using single sample *t*-tests, dependent mean *t*-tests, *z*-tests, decision errors, effect size, power, and computation of confidence intervals. The third examination consisted of multiple-choice questions and one hypothesis testing procedure covering independent mean t-tests, analysis of variance, chi-square tests, rank-order tests, and specific advanced statistical procedures (e.g., hierarchical multiple regression, factor analysis, structural equation modeling). Examinations were graded objectively by the lecturing professor and a graduate student instructor. Partial credit for hypothesis testing responses was possible and awarded according to an objective scoring rubric.

In the laboratory sessions, graduate student instructors reviewed lecture material, demonstrated the use of statistical analysis using IBM SPSS Statistics (IBM Corporation, 2021), and administered weekly quizzes. Additionally, two undergraduate peer tutors, who had previously taken the course and earned high marks, were available for voluntary tutoring for approximately 4-6 hours per week to reinforce course concepts and prepare students for exams. The laboratory grade was computed based on average scores of weekly homework assignments (60%), multiple-choice quizzes (15%), and attendance/participation (25%). Homework assignments and laboratory quizzes were graded objectively by a graduate student instructor according to a detailed scoring rubric. Students' final course grades were calculated based on scores on the three in-class exams (each worth 23%), overall lab grade (26%), attendance during lectures (2%), and a brief in-class presentation (3%).

Statistical Analyses

Descriptive statistics were calculated for the variables with means and standard deviations for the continuous variables and frequency and percentage for the categorical variables. The McNemar test was performed to compare the self-efficacy and outcome expectancy variables from baseline to follow-up on the third exam because it was the performance measure closest in time to follow-up. Multivariate logistic regression was performed to examine the factors that affected the self-efficacy and outcome expectancy variables. IBM SPSS Statistics version 28 (IBM Corporation, 2021) was used for all the analyses. All *p*-values were two-tailed. Of the 286 participants, nine total students were not included in regression analyses. One student was not included because of missing laboratory quiz grades. Six other students were excluded because they did not respond to all the procrastination questions in the post-questionnaire and two other students were excluded because they did not indicate their current year in college.

Results

Table 1 shows sample descriptive statistics. More than three-quarters (76.6%) of participants identified as female, which could indicate overall increased negative outcome expectancy for course outcomes (van Es & Weaver, 2018). College year was almost equally distributed with approximately one-third for each category, with third-year students representing the largest category. The fourth and other category included fourth-year students (n=64), students in a year greater than their fourth year (n=11), those obtaining their second bachelor's degree/non-graduate post-baccalaureate status (n=2), graduate students (n=2), non-degree-seeking students (n=3), and unknown (n=1). Toward the end of the semester (i.e., week 15), approximately two-thirds of students reported that they were likely to engage in help-seeking behavior when they got stuck or did not understand course content. Mean exam scores were slightly above 80 for Exam 1, approximately 75 for Exam 2, and slightly above 70 for Exam 3. Mean lab quiz scores were slightly above 80. Mean procrastination scores were approximately 10.4 (lowest score was 4 and highest score was 20), which was slightly above the midpoint of possible scores, slightly tilting in the direction of higher procrastination. Self-efficacy lowered from slightly above 90% of participants at baseline endorsing a statement of feeling capable of mastering course material to approximately three-quarters feeling the same way towards the end of the course. Additionally, outcome expectancy shifted negatively with about 95% of participants expecting to do well at the beginning of the course to slightly above 80% by the end of the course.

Table 2 shows McNemar test comparisons from baseline to follow-up for agreeing with the statistics self-efficacy item, "I am [was] quite capable of mastering the material in this class." For the entire sample, for those who scored below 70, and those who scored below 80 on Exam 3, there was a statistically significant percentage decrease in statistics self-efficacy from baseline to follow-up. There were no statistically significant percentage decreases in reported statistics self-efficacy from baseline to follow-up for those who scored 80-89.9 or 90-100 on Exam 3.

Table 3 shows McNemar test comparisons from baseline to follow-up for disagreeing with the outcome expectancy item "I will [would] never [be able to] do well in this course." In both the entire sample and those who scored below 70 on Exam 3, there was a statistically significant percentage decrease in positive outcome expectancy from baseline to follow-up. There were no statistically significant percentage decreases from baseline to follow-up for those who scored from 70-79.9, 80-89.9, or 90-100 on Exam 3.

Table 4 shows multivariate logistic regression analyses for follow-up of agreeing with the self-efficacy item "I was quite capable of mastering the course material in this class." Higher scores on the first two exams were each statistically significantly associated with increased odds for high self-efficacy. The other variables were not statistically significantly associated with high self-efficacy.

Table 5 shows multivariate logistic regression analyses for follow-up of positive outcome expectancy. No variables were significantly associated with positive outcome expectancy.

Discussion

In the current study, both high self-efficacy and positive outcome expectancy significantly decreased from baseline to follow-up in univariate analyses for lower-performing students on the third (and final) exam of the semester. In our multivariate analyses, we found that test performance on Exams 1 and 2 was significantly associated with increased odds of high self-efficacy. Positive outcome expectancy, however, was not associated with any of the aforementioned variables; thus, as predicted, outcome expectancy was less susceptible to change throughout the course.

As reported, higher scores on the first two exams were associated with high self-efficacy. This is consistent with previous findings of a moderate correlation between self-efficacy and course performance in statistics (Hii et al., 2013; McGrath et al., 2015; Waples, 2016). Importantly, we found that as performance decreased so did self-efficacy for the course. This was expected, as student performance is positively connected to student confidence (Sucuoğlu, 2018). We did not find a significant association between Exam 3 performance and increased odds for high self-efficacy. We speculate that students adjusted their self-efficacy based on performance on the earlier exams and by the final exam (Exam 3), their self-efficacy was less susceptible to change. In light of this finding, instructors could track critical points where students' self-efficacy decreases, discuss self-efficacy directly at the outset of the course, and provide explicit strategies to enhance self-efficacy in those who are ambivalent or struggling in an introductory statistics course. After all, students with higher self-efficacy are more likely to continue engaging with statistics potentially leading to improved statistics performance (Gopal et al., 2018).

In our univariate analyses, we found a similar pattern for high self-efficacy and positive outcome expectancy. Students who obtained lower Exam 3 scores from 0-69.9 showed decreases in both high self-efficacy and positive outcome expectancy from baseline to follow-up. Conversely, for those who obtained higher scores of 80 or higher on Exam 3, no statistically significant changes were found for high self-efficacy and positive outcome expectancy from baseline to follow-up. Essentially, self-efficacy and outcome expectancy changed in the same direction as performance on the final exam. These directional changes are expected as students' perceived competence is based on mastery experiences (Bandura, 1986; 1997), including past successes as well as failures (Fong & Krause, 2014). In our multivariate analysis, no variables were significantly associated with positive outcome expectancy. This adds to the mixed findings of previous literature reporting achievement (exam grades) as associated with (Hood et al., 2012) and not associated with outcome expectancy (Budé et al., 2007). However, our finding is similar to the finding of effort (self-reported help-seeking) and outcome expectancy having no significant relationship (Budé et al., 2007; Esnard et al., 2021; Hood et al., 2012).

Limitations

This study has certain limitations. We combined first year with second year students and fourth year with more senior students because our samples of those students were much smaller compared to the number of third year students. Responses to the self-efficacy and outcome expectancy questions were also dichotomized because of limited variability in the responses. Second, self-efficacy and outcome expectancy were each self-assessed by only one item to reduce participant burden (as the current study was part of a larger study of performance in statistics courses). Lengthier and validated measures of statistics self-efficacy, such as Current Statistics Self-Efficacy (CSSE) or Self-Efficacy to Learn Statistics (SELS; Finney & Schraw, 2003) should be used in future research to determine if there are similar patterns as in our study. Third, contextual factors such as sequence of courses, office hour meetings, and prerequisites were not included.

Recommendations

Considering our findings, we recommend that statistics instructors identify students who are at risk for decreasing self-efficacy. Furthermore, instructors should help foster high self-efficacy in students by directly connecting course content to students' everyday lives, incorporating formative low-stakes assessments that may help increase students' mastery experiences (Zientek et al., 2019), training students to employ study strategies (Liao & Wang, 2018), and teaching about growth mindset (Samuel & Warner, 2021). Given the anxiety felt by students enrolling in statistics courses, a brief training based on this targeted instruction could be offered to statistics instructors to help them comprehend common pitfalls and psychological variables that could help students navigate such a challenging course.

Researchers found an improvement in statistics performance that correlated with post self-efficacy scores only for undergraduate students who first solved statistics problems in a group setting, in which each member provided explanations for their own answers, gave feedback on the answers and explanations of the other group members, and then solved the same problems again individually with no feedback, compared to students who only solved the problems once, individually, with no feedback (Hall & Vance, 2010). Additionally, they suggested students be provided an explanation of the course material prior to measuring their statistics self-efficacy so that students can give an accurate assessment of their ability. Based on their findings, we recommend that students be given opportunities to compare their statistics problem-solving and answer-choice rationale to their peers' statistics problem-solving and answer-choice rationale in low-stakes assessments. It is also vital that these opportunities be provided numerous times throughout a statistics course so that changes in their self-efficacy and performance remain congruent and improve.

Conclusion

In conclusion, through our multivariate analyses, we found that greater performance on class exams early in the semester was associated with high self-efficacy. Change in positive outcome expectancy was not associated with exam performance. However, lower-performing students demonstrated decreases in both higher self-efficacy and positive outcome expectancy. Self-efficacy was more vulnerable to course performance and strategies to address this should be considered as self-efficacy is a predictor of academic success and achievement in statistics (Johnson & Kuennen, 2006; Mihai-Bogdan et al., 2015; Olani et al., 2011; Ramirez et al., 2012; Walker & Brakke, 2017).

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Table 1

Descriptive Statistics of Sample

Variable	Frequency	Percentage	Mean	Standard Deviation
Sex				
Women	219	76.6%		
Men	67	23.4%		
College year				
First & Second	91	31.8%		
Third	110	38.5%		
Fourth & Other	83	29.0%		
Missing	2	0.7%		
Self-reported help-seekers	191	66.8%		
Self-reported non-help-seekers	95	33.2%		
Exam 1			82.25	12.11
Exam 2			74.53	14.18
Exam 3			71.03	15.85
Lab quiz score (n=285)			81.29	11.75
Procrastination (n=280)			11.35	3.35
Pre-Self-Efficacy (high)	266	93%		
Pre-Self-Efficacy (low)	20	7.0%		
Post-Self-Efficacy (high)	220	76.9%		
Post-Self-Efficacy (low)	66	23.1%		
Pre-Outcome Expectancy (Positive)	273	95.5%		
Pre-Outcome Expectancy (Negative)	13	4.5%		
Post-Outcome Expectancy (Positive)	236	82.5%		
Post-Outcome Expectancy (Negative)	50	17.5%		

Table 2

Comparisons of High Self-Efficacy from Baseline to Follow-Up

Variable	Statistics Self-Efficacy Baseline Frequency	Percent	Statistics Self-Efficacy Follow-up Frequency	Percent	p-value
Entire Sample (*n*=286)	266	93.0%	220	76.9%	<0.001
Exam 3 score 0-69.9 (*n*=126)	114	90.5%	76	60.3%	<0.001
Exam 3 score 70-79.9 (*n*=67)	66	98.5%	59	88.1%	0.04
Exam 3 score 80-89.9 (*n*=62)	55	88.7%	55	88.7%	1.00
Exam 3 score 90-100 (*n*=31)	30	96.8%	30	96.8%	N/A

Note. N/A= not applicable since baseline had 100% agreement.

Table 3

Comparisons of Positive Outcome Expectancy from Baseline to Follow-up

Variable	Outcome Expectancy Baseline Frequency	Percent	Outcome Expectancy Follow-up Frequency	Percent	p-value
Entire Sample (n=286)	273	95.5%	237	82.9%	<0.001
Exam 3 score 0-69.9 (n=126)	119	94.4%	91	72.2%	<0.001
Exam 3 score 70-79.9 (n=67)	66	98.5%	60	89.6%	0.07
Exam 3 score 80-89.9 (n=62)	57	91.9%	56	90.3%	1.00
Exam 3 score 90-100 (n=31)	30	96.8%	30	96.8%	N/A

Note. N/A= not applicable since baseline had 100% agreement.

Table 4

Logistic Regression Analyses for Follow-up of High Self-Efficacy

Variable	Odds Ratio	95% Confidence Interval (lower, upper)	p-value
Sex (women)	1.34	0.56, 3.20	0.51
College year			
First & Second	1.00		
Third	0.93	0.38, 2.27	0.88
Fourth & Other	1.20	0.53, 2.71	0.67
Self-reported help-seekers	0.61	0.29, 1.30	0.20
Exam 1	1.05	1.00, 1.10	0.04
Exam 2	1.07	1.02, 1.11	0.002
Exam 3	1.03	1.00, 1.06	0.11
Lab quiz score	0.98	0.95, 1.02	0.39
Procrastination	0.92	0.83, 1.03	0.13
Self-efficacy baseline	0.50	0.14, 1.69	0.26

Table 5

Logistic Regression Analyses for Follow-up of Positive Outcome Expectancy

Variable	Odds Ratio	95% Confidence Interval (lower, upper)	p-value
Sex (women)	1.07	0.45, 2.55	0.87
College year			
First & Second	1.00		
Third	1.34	0.56, 3.21	0.51
Fourth & Other	2.12	0.93, 4.84	0.76
Self-reported help-seekers	1.07	0.50, 2.30	0.85
Exam 1	1.03	0.99, 1.08	0.19
Exam 2	1.00	0.96, 1.04	0.98
Exam 3	1.03	1.00, 1.06	0.09
Lab quiz score	1.04	1.00, 1.08	0.09
Procrastination	0.95	0.86, 1.06	0.36
Outcome expectancy baseline	3.16	0.83, 12.04	0.09