Engineering Educators Bringing the World Together
2025 ASEE Annual Conference & Exposition
Palais des congrès de Montréal, Montréal, QC • June 22–25, 2025 ASEE
Paper ID #47065

WIP: Students' Emotional and Study Strategies Responses to ECE Exam Success and Failure

Dr. Juan Alvarez, University of Illinois at Urbana - Champaign

Juan Alvarez joined the Department of Electrical and Computer Engineering at University of Illinois faculty in Spring 2011 and is currently a Teaching Assistant Professor. Prior to that, he was a Postdoctoral Fellow in the Department of Mathematics and Statistics at York University, Canada, a Postdoctoral Fellow in the Chemical Physics Theory Group at the University of Toronto, Canada, and a Postdoctoral Fellow in the Department of Mathematics and Statistics at the University of Saskatchewan. He obtained his Ph.D. and M.S. from the Department of Electrical and Computer Engineering at the University of Illinois in 2004 and 2002, respectively. He teaches courses in communications, signal processing and probability.

Jessica R Gladstone, University of Illinois Urbana-Champaign
Jennifer Cromley, University of Illinois Urbana-Champaign

Jennifer Cromley is Professor of Educational Psychology at the University of Illinois at Urbana-Champaign. Her research focuses on two broad areas: achievement/retention in STEM and comprehension of illustrated scientific text

Zhengyan Ye

WIP: Students' Emotional and Study Strategies Responses to ECE Exam Success and Failure

Introduction

In engineering as a profession and in engineering education, failure is commonplace[1]–attempted designs fail, experiments fail about 90% of the time, and students do not achieve the scores they desire on homework, quizzes, and exams. Thus, the ability to navigate and respond to failure as an opportunity for growth and learning is a key component of the scientific enterprise. However, engineering education research is sparse on how students respond to failure.

Research on response to failure has been extensive in workplace settings[2, 3], in which there is a very wide range of negative and positive responses to failure, including denial, anger, bargaining, depression, acceptance, working harder, working smarter, shock, fear, renewed dedication, increased susceptibility to stereotypes, blame, shame, despair, changes in interest, reassessing career, reassessing self-perceived ability, and learning from failure[2]. Thus, these responses may include combinations of emotional, cognitive, and behavioral responses. Research on responses to success likewise suggests positive emotions in response to success on work projects, such as pride, satisfaction, and happiness. Educational research on response to failure across different domains and ages–not just in engineering education–has been quite narrow because research has used theories that make very narrow predictions about response to failure, like self-belief theory[4], achievement goal orientation[5], expectancy-value theory[6], interest theory[7], etc. Educational research on response to success has been sparse, but also suggests positive emotions in response to success.

An education-specific theory, Pekrun's control-value theory of achievement emotions[8], catalogues a range of emotions experienced by students in achievement-related situations. For example, immediately after high-stakes end-of-year oral exams, education majors in Pekrun et al.[8] identified admiration, anger, anxiety, disappointment, envy, gratitude, hope, hopelessness, joy, pride, relief, sadness, satisfaction, security, shame, and surprise as emotional reactions either just before taking the exam, during the exam, and/or immediately after the exam but before receiving results. Positive test-related emotions were positively correlated with previous semester cumulative GPA, and negative test-related emotions were negatively correlated with previous semester cumulative GPA. Thus, Pekrun's control-value theory of achievement emotions when instantiated in test-taking context does capture a wide range of emotional responses to test-taking, but does not address any of the cognitive aspects of responses to graded activities.

In this Work In Progress, we have created two questionnaires about student responses to exam success and failure in engineering courses. The questionnaires were developed based on 55

interviews conducted in 2023-24 and then edited based on cognitive interviews[9] collected on the draft questionnaires in summer 2024 (Study 1). The first round of questionnaire administration (Study 2) was completed in Fall, 2024. Results of the 55 interviews were reported previously at ASEE. A 19-question scale on emotional responses to receiving one's own exam results and a 22-question scale on planned study strategy changes for the next course exam was drafted based on themes found during the interview process.

Study 1

In study 1, we drafted the two questionnaires, conducted cognitive interviewing with 5 engineering students, and revised the wording of 7 questions.

Cognitive interviewing questionnaires

Based on the emotions and study strategy changes mentioned in the interviews, we created the two questionnaires in summer 2024. The first question asked about perceived performance on one most recent exam "Compared to how I thought I would do, on the last exam I: did better than expected, did as expected, did worse than expected."

Post-exam emotions questionnaire

The instructions for the emotions questionnaire were as follows: "Please rate each of the choices below for your agreement regarding how you felt after learning about your last exam grade in this engineering course." The 4-point response scale for the emotions questionnaire was "Strongly disagree... Disagree... Agree... Strongly agree." The emotions questionnaire had 8 positive emotions items, 11 negative emotions, and 3 'surprised' items (e.g., "Surprised by my score, in a good way"), all of which were presented in alphabetical order (from Afraid through Worth it) to avoid any item carryover.

Post-exam study strategy changes questionnaire

The instructions for the study strategy changes questionnaire were as follows: "Please indicate how you plan to change your exam study strategies listed below to prepare for the next exam in the same course, after learning about your last exam grade in an engineering course." The response scale for the study strategy changes questionnaire was "Use it more (including didn't use it before but plan to use it on the next exam)... Use it the same amount... Use it less (but still use it on the next exam)... Drop it... Never used it and don't plan to use it." The planned changes to study strategy questionnaire asked about 19 strategies, plus an open-ended option where respondents could type a strategy we had not listed. As with the emotions questionnaire, the items were listed alphabetically (from Course communication tool through Tutoring session). Note that we created items for the most common strategies mentioned in interviews, even though some of these–e.g., searching on the internet–seemed less than optimal because they are quite different from what is taught in the course and how it is taught (we refer to this as more-distant strategies below).

Cognitive interviewing participants and procedures

We recruited 5 engineering undergraduate students from our institution who self-identified as having recently taken an engineering exam to complete cognitive interviews. Participants were compensated with a $20 electronic Amazon gift card for their time.

Participants scheduled an online meeting time via Teams, and their verbalizations were audio recorded in the Teams meeting. The consent form, questionnaires and demographics form were all presented in a secure Learning Management System site which had all participant communication functionalities hidden (e.g., People, Discussions). After participants provided online informed consent, we gave instructions for the cognitive interviewing as follows: "What we are asking you to do is to answer some questions about how you respond when you hear what score you got on an engineering exam. I want you to think about one particular exam you took recently in an engineering course while you are answering the questions. While you are answering the questions, I want you to say everything you are thinking out loud, including reading each question out loud. Let me demonstrate what this might look like; I'm going to think out loud while answering a question you are not going to see: On a scale from 1 to 4 where 4 is completely agree and 1 is completely disagree, how likely are you to buy a car in the next year? Well, let's see, my car is pretty old which does make me want to replace it, but at the same time cars have gotten really expensive, which means probably taking out a car loan and I would be saving less. So overall, it's a 3 for me. Now if I had found anything unclear or confusing I would have said out loud 'that's confusing' or 'I don't know what you mean' or something like that. Do you have any questions about saying what you're thinking while answering questions about one recent engineering exam? [Answer participant's questions.]"

Script for cognitive interview on emotions

For the emotions items we added, "The first set of questions is about how you felt when you received your exam score on that exam. I am just here to make sure the recording is working, so I won't be talking with you unless you aren't verbalizing what you're thinking while answering the first set of questions. There will be 23 questions that take about 15 minutes."

We did not need to prompt participants to think out loud while answering the questions. As is typical for cognitive interviewing [9], in response to student comments we offered specific improvements in real time and asked for participant feedback. For example, a student verbalized confusion about how to answer a question that was initially worded "Resigned/Accepting it is what it is/Came to terms with it/OK with it". We asked if the following would be clearer—"OK with it/Resigned/Accepting it is what it is/Came to terms with it"—and the student affirmed that they would find the item clearer in the re-worded version. After completing the audio recorded cognitive interview, the recording was stopped and participants filled out a brief demographics form. We did not transcribe the video recordings.

Based on the results of the cognitive interviewing on the emotions items, we added reminders after every 7 questions to "Remember to answer about how you felt after you learned your score on the most recent engineering exam" and we made minor wording changes to 5 items.

Script for cognitive interview on changes to study strategies

After the emotions items we added, "The second set of questions is about how you might change how you study for the next engineering exam. Go ahead and open up the second questionnaire. Notice that the questions are about what you plan to change; change by using the strategy more, using the strategy the same amount, change by using the strategy less, change by dropping the strategy entirely, or you never used the strategy in the first place and you don't plan on using it to prepare for your next exam. Be sure to say what you're thinking as you answer the questions, including reading the question out loud. Are you ready? [If so,] OK, start answering the questions."

Based on the results of the cognitive interviewing on the planned changes to study strategies items, we added reminders after every 7 questions to "Remember to answer about how you would prepare for the next exam, compare to how you prepared, don't compare to others." And we made minor wording changes to 2 items.

Study 2

Questionnaire validation–Questionnaire

We administered the revised questionnaire to 241 students from one engineering course. The two final questionnaires are shown in Supplementary tables A and B. We administered these to 241 undergraduates from one sophomore-level engineering course in Fall 2024. The instructions for each questionnaire and the response scales were identical to those used in the cognitive interviewing, together with the reminders mentioned above (e.g., 'Remember to answer about how you would prepare for the next exam').

Questionnaire validation–Participants

With IRB approval, participants completed all measures as a homework assignment, and consented (or did not consent) to release the data to the team for research purposes. Research participants were 241 Engineering majors recruited from a single Electrical & Computer Engineering course in Fall 2024. Their mean age was 19.4 (SD = 1.0) and all were traditional college-aged students. Their self-identified gender identity was 84% male, 12% female, and 4% other or preferred not to say. Females were somewhat under-represented among those who completed the questionnaires and released data, compared to the course demographics. Of those who self-identified race, 161 (76%) were Asian, 50 (24%) were White, 10 (5%) were Latino/Latina, 5 (3%) were Middle Eastern, 4 (2%) were Black, and 7 (3%) self-identified as mixed race or of another race(s). Of those who indicated the highest level of education completed by a parent(s), 26 (11%) were first-generation college students, defined as neither parent having completed a bachelor's degree.

Questionnaire validation–Procedure

Participants completed all measures in a Learning Management System over a 1-week period beginning the day their course grades on the first semester exam were released to them. They answered all questionnaires from their own computer or a university computer at a place and time convenient to them. After completing the emotions questionnaire and the planned study strategies change questionnaire, they answered whether they would consent to release their data, and if they said yes, they completed the demographics form (see above for questions).

Questionnaire validation–Results

All 241 participants responded to the question regarding whether they did worse than they had expected to do on the exam (n = 66, 27%), did the same as they had expected (n = 95, 39%), or did better (n = 80, 33%). For descriptive statistics by group, see Appendix A.

With regard to reliability, all scales showed good Cronbach's alpha: positive emotions, .88; negative emotions, .92, and planned changes to study strategies, .80. Exploratory factor analysis (principal axis factoring with oblimin rotation) suggested that the positive emotions could be treated as a factor and the negative emotions could be treated as a factor, supporting the validity of these scales. However, there was no clear factor structure for the planned changes to study strategies, likely due to idiosyncratic patterns of strategy choice. We did find significant co-occurrences of strategies; for example, students who more often planned to read the textbook also more often planned to go to office hours. This set of significant co-occurrences supports the validity of the planned changes to study strategies scale.

We created two factor scores (M = 0.00, SD = 1.00), one for positive emotions and one for negative emotions; these scores were correlated r = -.78. Not surprisingly, those who had more-positive emotions tended to score low on negative emotions, and vice versa. However, these factor scores were not correlated at -1.0, meaning that students tended to have mixed emotions; a student might get a worse grade than they expected, but still be relieved to learn their grade on the exam.

A one-way ANOVA on positive emotions by performance groups ($F [2, 235] = 55.274$, MSE = 0.447, $p < .001$) showed that those who did better than expected had significantly higher positive emotions scores (M = 0.72) compared to those who did as expected (M = 0.10), who scored significantly higher than those who did worse than expected (M = -1.02). The differences between the factor scores can be interpreted as an effect size, so the did-better group showed a huge effect on positive emotions (d = 1.74) compared to those who did worse.

A one-way ANOVA on negative emotions by performance groups ($F [2, 235] = 38.052$, MSE = 0.599, $p < .001$) showed that those who did worse than expected had significantly higher negative emotions scores (M = 0.88) compared to those who did as expected (M = -0.16), who scored significantly lower than those who did better than expected (M = -0.54). The differences between the factor scores can be interpreted as an effect size, so the did-worse group showed a huge effect on negative emotions (d = -1.42) compared to those who did better. See Appendix B for full ANOVA results for each emotion.

For planned changes to strategy use, a series of 3 (performance group) x 4 (response options) chi squared tests showed few statistically significant differences among groups (see Appendix C for full results). However, there were 3 significant differences. Those who did better than expected planned to increase their use of studying more than one day before the exam, whereas those who did as expected planned to keep this the same. Those who did worse than expected planned to do more practice from homework, whereas those who did as expected planned to use it the same. Finally, those who did worse than expected planned to go to more of the exam review sessions.

We also created a composite score for strategies that were more distant from course content (using the textbook, going to review sessions, and using the internet). A one-way ANOVA on these more-distant strategies by performance groups ($F [2, 238] = 6.27$, $MSE = 8.12$, $p = .002$) showed that those who did worse than expected intended to add significantly more- distant strategies ($M = 9.1$, $d = .40$) compared to those who did as expected ($M = 7.9$), who did not differ from those who did better than expected ($M = 7.5$). Students who did worse than expected seemed to realize that they should add more study strategies, but were unclear on which strategies might be useful.

Conclusions

The literature shows a clear pattern of negative emotions after failure; here we found this pattern for perceived failure and also showed the opposite pattern for perceived success. Furthermore, all groups–did better, did as expected, and did worse–show mixed emotions rather than polarized emotions. That is, even those who do better than expected still have some negative emotions, and those who did as expected have a relatively even mix of negative and positive emotions.

Our findings suggest that instructors, TAs, and academic advisors who interact with students after they receive exam scores should pay attention to both positive and negative emotions after success and failure, and should guide students to understand those emotions in an adaptive way. For example, even students who perceive their exam score as a success are likely to have some negative emotions, and this mix of positive and negative emotions may help them to keep a sense of balance rather than having positive emotions undermine subsequent learning efforts. Conversely, for students who perceive their exam score as a failure, having some positive emotions may help them keep striving, and their negative emotions may energize subsequent learning efforts.

Instructors could model some emotion regulation or coping strategies, such as taking a deep breath, normalizing the semester-long pattern, and emphasize the possibility of improving ways of studying in order to do better in the future.

Compared to other research on undergraduate study strategies, the strategies named by students were generally those that are described as adaptive in the literature (e.g., students never named surface strategies such as flashcards or memorization). Nonetheless, ‘distance’ from the course content–such as Internet searches vs. office hours–does explain group differences. Students should be advised to stay close to course content when studying.

Our questionnaires may have forced students to reflect on which strategies they used and how useful they were; these kinds of metacognitive skills in monitoring the use of and planning the use

of study strategies should be modeled and encouraged to help students study most effectively. Interventions could include making students more self-reflective about their own strategy use (e.g., a self-regulated learning intervention).

Our study had a few limitations; even relative to undergraduate engineering majors, women were under-represented in our sample and results probably generalize to men more than to women. We recruited a small sample for this preliminary test of scale validity; a larger sample size will be needed to test factorial validity, criterion validity, and fairness of scales. We plan to collect such data in February, 2025. We gathered data at only one time point, but more time points are needed to observe the effects of emotional responses and strategy use.

In sum, we show that there is a continuum in the mixture of positive and negative post-exam emotions, which follows the did-better (more positive), did the same (even mix), did-worse (more-negative) continuum of performance. We also show that those who did worse than expected plan to add to the repertoire of the study strategies they plan to use, but that they are somewhat indiscriminate about what they plan to add, whereas those who did as expected or did better seem to focus their intended strategies on 'close to course content' strategies.

Based on these findings, we are creating a peer-to-peer web based intervention for fall 2025. ECE students will be coached through naming the coping strategies they have used, and they will record a brief 2-5 minute testimonial for current students to watch and learn about effectively coping with perceived failure and perceived success. Participating fall 2025 students will write a brief reflection on each video they watch. Extent of engagement with videos will be used to predict subsequent scores on a coping strategies questionnaire and our use of study strategies measure. Results will be shared with departmental faculty, academic advising staff, and in a subsequent ASEE proposal.

References

[1] A. Simpson and A. Maltese, "Failure is a major component of learning anything": The role of failure in the development of stem professionals," *Journal of Science Education and Technology*, vol. 26, pp. 223–237, 2017.

[2] K. C. Newton, N. A. and J. Thompson, "Workplace failure: Mastering the last taboo," *Consulting Psychology Journal: Practice and Research*, vol. 60(3), p. 227–245, 2008.

[3] S. N. Hareli, S. and N. Biger, "The role of emotions in employees' explanations for failure in the workplace," *Journal of Managerial Psychology*, vol. Vol. 20 No. 8, pp. pp. 663–680, 2005.

[4] C. S. Dweck, *Self-theories: Their role in motivation, personality, and development*. Psychology Press., 2000.

[5] A. J. Elliot and H. A. McGregor, "A 2x 2 achievement goal framework," *Journal of Personality and Social Psychology*, vol. 80(3), pp. 501–519, 2001.

[6] A. Wigfield and J. S. Eccles, "Expectancy–value theory of achievement motivation," *Contemporary Educational Psychology*, vol. 25(1), pp. 68–81, 2000.

[7] S. Hidi and K. A. Renninger, "The four-phase model of interest development," *Educational Psychologist*, vol. 41(2), pp. 111–127, 2006.

[8] R. Pekrun, T. Goetz, R. P. Perry, K. Kramer, M. Hochstadt, and S. Molfenter, "Beyond test anxiety: Development and validation of the test emotions questionnaire (teq)," *Anxiety, Stress and Coping*, vol. 17(3), pp. 287–316, 2004.

[9] J. P. Leighton, *Using think-aloud interviews and cognitive labs in educational research*. Oxford University Press, 2017.

Appendix A: Means by Groups by Emotion

Means by group by emotion	dw	ds	db	Graph
Afraid/Worried/Nervous/Anxious	2.91	2.35	1.96	
Angry	2.55	1.79	1.44	
Annoyed/Irritated	2.92	2.15	1.73	
Bad	2.89	1.91	1.56	
Confident	2.17	2.75	2.90	
Confused	2.36	2.07	1.86	
Disappointed	3.24	2.13	1.49	
Discouraged	2.56	1.80	1.48	
Frustrated	2.88	1.96	1.53	
Happy	1.85	2.77	3.35	
Not confident	2.70	2.04	1.83	
Not disappointed	1.85	2.69	3.18	
Not surprised	2.41	2.85	2.26	
Not worth it	2.09	1.83	1.93	
OK with it	2.67	2.93	3.00	
Proud	1.73	2.66	3.21	
Reassured	1.86	2.72	3.04	
Relaxed	2.09	2.77	3.20	
Relieved	2.03	2.63	3.20	
Surprised in a good way	1.82	2.44	3.25	
Surprised in a bad way	2.82	1.99	1.58	
Worth it	2.45	3.06	3.21	

Note: dw = did worse on exam than expected, ds = did same on exam as expected, db = did better on exam than expected

Appendix B: Three-group ANOVA Results by Emotion

	F	p
Afraid/Worried/Nervous/Anxious	20.163	$< .001$
Angry	41.857	$< .001$
Annoyed/Irritated	38.088	$< .001$
Bad	60.172	$< .001$
Confident	21.415	$< .001$
Confused	7.351	0.001
Disappointed	109.447	$< .001$
Discouraged	37.198	$< .001$
Frustrated	50.413	$< .001$
Happy	77.771	$< .001$
Not confident	23.352	$< .001$
Not disappointed	54.717	$< .001$
Not surprised	18.713	$< .001$
Not worth it/Not worth the effort of studying for it /Not worth the time taken to study for it	1.774	0.172
OK with it/Resigned/Accepting it is what it is /Came to terms with it	3.956	0.02
Proud	76.335	$< .001$
Reassured	51.064	$< .001$
Relaxed (tension in my body has gone away, I feel chill)	36.199	$< .001$
Relieved (I was worried before I knew my score, but now I am not worried any more)	45.083	$< .001$
Surprised by my score, in a good way	83.14	$< .001$
Surprised by my score, in a bad way	61.62	$< .001$
Worth it	19.495	$< .001$

Appendix C: Three-group Chi Squared Results by Study Strategy

	Did Worse	**Did As Expected**	**Did Better**	χ^2	**p**
1. Use course communication tool				8.6	0.198
Drop it	2 (0.94)	2 (0.44)	0 (-1.38)		
Use it less	4 (-0.82)	7 (-0.24)	8 (1.05)		
Use it the same	21 (-1.73)	36 (0.32)	32 (1.35)		
Use it more	18 (2.18)	16 (-0.34)	9 (-1.77)		
2. Review more than one day before exam				17.61	0.007
Drop it	1 (-0.71)	1 (0.30)	0 (-0.98)		
Use it less	3 (0.17)	1 (-1.97)	6 (1.90)		
Use it the same	21 (-1.19)	49 (3.63)	20 (-2.66)		
Use it more	39 (0.97)	41 (-2.81)	49 (2.01)		
3. Practice from/re-do homework				12.84	0.046
Drop it	0 (-0.63)	1 (1.29)	0 (-0.72)		
Use it less	0 (-2.25)	6 (0.92)	6 (1.21)		
Use it the same	26 (-1.60)	47 (1.58)	37 (-0.09)		
Use it more	37 (2.72)	29 (-2.18)	32 (-0.36)		
4. Use internet (such as YouTube, Chat GPT, etc.)				9.07	0.17
Drop it	1 (1.58)	0 (-0.81)	0 (-0.69)		
Use it less	1 (-1.73)	7 (1.11)	5 (0.51)		
Use it the same	32 (-1.29)	50 (0.13)	44 (1.11)		
Use it more	25 (2.01)	24 (-0.60)	17 (-1.33)		
5. Attend lecture/view videos				2.67	0.614
Use it less	0 (-1.24)	2 (0.43)	2 (0.72)		
Use it the same	38 (-0.81)	61 (0.59)	50 (0.15)		
Use it more	27 (1.15)	31 (-0.71)	27 (-0.35)		
6. Read and/or take notes				1.96	0.744
Use it less	5 (1.09)	3 (-1.05)	4 (0.05)		
Use it the same	35 (-0.87)	55 (0.35)	46 (0.46)		
Use it more	25 (0.39)	34 (0.12)	26 (-0.50)		

	Did Worse	Did As Expected	Did Better	χ^2	p
7. Go to office hours				6.3	0.391
Drop it	1 (-0.48)	1 (-0.81)	3 (1.29)		
Use it less	3 (0.03)	3 (-0.49)	4 (0.47)		
Use it the same	15 (-1.96)	30 (1.09)	26 (0.77)		
Use it more	39 (2.03)	39 (-0.59)	32 (-1.37)		
8. Practice exams–check correctness of my answers				5.09	0.533
Drop it	1 (1.62)	0 (-0.80)	0 (-0.71)		
Use it less	0 (-0.88)	1 (0.32)	1 (0.51)		
Use it the same	30 (-1.27)	52 (0.94)	42 (0.23)		
Use it more	35 (1.22)	40 (-0.90)	36 (-0.23)		
9. Practice exams–pick selected questions to practice				3.58	0.733
Drop it	1 (1.58)	0 (-0.82)	0 (-0.68)		
Use it less	3 (-0.29)	6 (0.73)	3 (-0.49)		
Use it the same	31 (-0.68)	46 (-0.08)	39 (0.75)		
Use it more	29 (0.61)	37 (-0.14)	28 (-0.44)		
10. Practice exams–do not attempt any problems but only check solutions				9.62	0.141
Drop it	10 (2.07)	4 (-1.78)	5 (-0.21)		
Use it less	14 (0.21)	14 (-0.99)	14 (0.86)		
Use it the same	12 (-1.66)	23 (1.03)	16 (0.61)		
Use it more	7 (-0.03)	12 (1.57)	3 (-1.68)		
11. Practice exams–time myself				7.67	0.263
Drop it	2 (1.03)	2 (0.45)	0 (-1.44)		
Use it less	0 (-1.99)	6 (1.40)	4 (0.43)		
Use it the same	18 (-0.73)	28 (-0.27)	28 (0.97)		
Use it more	31 (1.32)	37 (-0.49)	31 (-0.73)		
12. Practice exams–do multiple exams				2.56	0.633
Use it less	3 (0.92)	2 (-0.57)	2 (-0.28)		
Use it the same	23 (-1.34)	40 (0.27)	37 (0.98)		
Use it more	39 (1.02)	50 (-0.08)	40 (-0.88)		
13. Attend a formal exam review session (TA, Eta Kappa Nu (HKN))				13.51	0.036
Drop it	2 (-0.59)	5 (1.09)	2 (-0.56)		
Use it less	0 (-3.08)	11 (1.85)	8 (1.15)		
Use it the same	24 (-0.37)	30 (-0.32)	27 (0.71)		
Use it more	34 (2.47)	28 (-1.26)	22 (-1.16)		
14. Look at lecture slides				3.97	0.681
Drop it	1 (0.68)	1 (0.29)	0 (-0.97)		
Use it less	3 (0.87)	3 (0.16)	1 (-1.01)		
Use it the same	39 (-1.06)	64 (1.15)	47 (-0.19)		
Use it more	23 (0.64)	25 (-1.30)	26 (0.76)		

	Did Worse	Did As Expected	Did Better	χ^2	p
15. Study alone				9.58	0.144
Drop it	1 (0.20)	1 (-0.23)	1 (0.05)		
Use it less	17 (1.47)	15 (-1.10)	14 (-0.26)		
Use it the same	32 (-2.66)	60 (0.65)	53 (1.88)		
Use it more	16 (1.82)	17 (0.39)	7 (-2.17)		
16. Study with others (not in a review session or office hours)				10.04	0.123
Drop it	1 (0.73)	0 (-1.13)	1 (0.47)		
Use it less	3 (-0.91)	10 (1.78)	4 (-0.98)		
Use it the same	21 (-2.06)	42 (0.74)	39 (1.18)		
Use it more	31 (2.46)	28 (-1.52)	27 (-0.74)		
17. Read/re-read textbook				3.62	0.728
Drop it	0 (-0.65)	1 (1.25)	0 (-0.68)		
Use it less	6 (0.94)	4 (-1.03)	5 (0.16)		
Use it the same	22 (-0.85)	33 (0.03)	29 (0.81)		
Use it more	29 (0.44)	38 (0.35)	27 (-0.79)		
18. Go to an individual tutoring session (from any source; not group/review sessions)				7.63	0.267
Drop it	1 (1.38)	0 (-0.82)	0 (-0.58)		
Use it less	2 (-1.02)	5 (0.66)	3 (0.36)		
Use it the same	13 (-1.89)	23 (0.99)	15 (0.95)		
Use it more	21 (2.24)	15 (-1.23)	9 (-1.06)		
19. Plan out my study days and times for this course in advance				12.21	0.057
Drop it	7 (-0.64)	16 (1.49)	8 (-0.94)		
Use it less	1 (-0.11)	3 (1.47)	0 (-1.42)		
Use it the same	19 (-2.23)	42 (1.01) 3	6 (1.06)		
Use it more	39 (2.66)	34 (-2.37)	36 (-0.05)		