

Supplemental Material

CBE—Life Sciences Education

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Table S1: Demographics of survey respondents pooled across the three post-exam retake surveys in Courses 1 and 2.	2
Table S2: Percentage of survey responses where an option was selected by a student as their reason for retaking the exam and demographic differences in the likelihood of picking an option.	3
Table S3: Percentage of survey responses where an option was picked by a student as their reason for not retaking the exam and demographic differences in the likelihood of picking an option.	3
Table S4: Percentage of survey responses that indicated agreement with a statement and demographic differences in the likelihood of agreement.	4
Figure S1: Odds ratios for exam score on first attempt (i.e., “First attempt score”) and demographic variables on students’ likelihood of retaking exams in Course 1.	6
Figure S2: Odds ratios for exam score on first attempt (i.e., “First attempt score”) and demographic variables on students’ likelihood of retaking exams in Course 2.	7
Figure S3: Odds ratios for exam score before a given retake opportunity and demographic variables on students’ likelihood of retaking exams in Course 3.	8
Figure S4: Boxplot of student score on first attempt and retakes by gender.	9
Figure S5: Boxplot of student score on first attempt and retakes by race/ethnicity.	10
Figure S6: Boxplot of student score on first attempt and retakes by Pell-eligibility.	11
Figure S7: Boxplot of student score on first attempt and retakes by number of hours a student worked a job during the semester.	12
Survey Questions.....	13
The following questions were presented to students who said they retook exam X.	13
The following questions were presented to students who said they did not retake exam X.....	16

Table S1: Demographics of survey respondents pooled across the three post-exam retake surveys in Courses 1 and 2.

Please note that students could have filled out the survey more than once, so this table does not indicate unique survey respondents.

	Course 1	Course 2
	N = 1,337	N = 1,239
Gender		
Female	935 (70%)	889 (72%)
Male	402 (30%)	350 (28%)
Race/Ethnicity		
Asian American	235 (18%)	226 (18%)
Black/African American	65 (4.9%)	54 (4.4%)
Hispanic/Latinx	307 (23%)	251 (20%)
International	52 (3.9%)	58 (4.7%)
Multiracial	76 (5.7%)	69 (5.6%)
White	602 (45%)	581 (47%)
Pell-eligible	441 (33%)	372 (30%)
Number of hours worked		
No	797 (60%)	873 (70%)
≤20 hours	400 (30%)	218 (18%)
>20 hours	140 (10%)	148 (12%)

Table S2: Percentage of survey responses where an option was selected by a student as their reason for retaking the exam and demographic differences in the likelihood of picking an option.

Students were asked to select all the options that apply to them. We pooled data from all three surveys here. - indicates that we did not run linear mixed effects for those because very few students (less than 10%) picked that option across all surveys in both courses. We accounted for multiple responses from the same student by using student ID as a random effect with varying intercepts in our models. We controlled for total student scores on first exam attempts in the models reported here.

	Course 1	Summary of demographic differences	Course 2	Summary of demographic differences
	N = 880		N = 1,033	
I was not satisfied with my score	77.16	Asian American students more likely to pick	86.66	No demographic differences
I thought I could improve my score	79.77	Men and International students less likely to pick	73.22	Men, International students, & Pell-eligible students less likely to pick
First attempt was encouraging	19.89	Men more likely to pick	7.32	No demographic differences
To help learn the material better	44.43	No demographic differences	48.24	Men less likely to pick
To practice my test-taking skills	22.84	No demographic differences	20.16	No demographic differences
Because my friends were retaking	5.45	-	4.41	-
To impress my instructor	1.93	-	2.51	-

Table S3: Percentage of survey responses where an option was picked by a student as their reason for not retaking the exam and demographic differences in the likelihood of picking an option.

Students were asked to select all the options that apply to them. We pooled data from all three surveys here. - indicates that we did not run linear mixed effects for those because very few students (less than 10%) picked that option across all surveys in both courses. n/a indicates options that were not applicable to the course. We accounted for multiple responses from the same student by using student as a random effect with varying intercepts in our models. We controlled for total student scores on first exam attempts in the models reported here.

	Course 1	Notes	Course 2	Notes
	N = 447		N = 261	
I was satisfied with my score	75.17	Students who work 1-20h/w less likely to pick & multiracial students more likely to pick	58.54	No demographic differences
I was discouraged by my score	4.01	-	9.35	-
I didn't think I could improve my score	34.9	Men less likely to pick	28.05	Latinx students less likely to pick
Taking exams makes me anxious	12.3	No demographic differences	13.41	No demographic differences
Too difficult to come to campus for retake	13.87	No demographic differences	n/a	
Signing up process was difficult	2.88	-	n/a	
Scheduling conflicts	26.52	No demographic differences	n/a	
Too busy	19.24	No demographic differences	33.74	Pell-eligible students were less likely to pick
Didn't feel like it	10.74	Students who work 1-20h/w less likely to pick	10.16	Pell-eligible students were more likely to pick
Planned to retake, but forgot	5.82	-	n/a	

Table S4: Percentage of survey responses that indicated agreement with a statement and demographic differences in the likelihood of agreement.

We pooled data from all three surveys here. X indicates that we did not run linear mixed effects for those because very few or too many students (less than 10% or more than 90%) picked that option across all surveys in both courses. n/a indicates options that were not applicable to the course. We accounted for multiple responses from the same student by using student as a random effect with varying intercepts in our models. We controlled for total student scores on first exam attempts in the models reported here. We did not control for student exam scores here, but include a similar table in the supplement that presents model results after controlling for total score on first exam attempts.

	Course 1	Notes	Course 2	Notes
Students that retook exams	% N = 880		% N = 1,033	

Retaking this exam helped my learning	96.7	x	94.68	x
Retaking reduced my anxiety about taking tests	81.48	No demographic differences	83.85	No demographic differences
Put a lot of effort into studying for retake	86.36	No demographic differences	85.86	International students and students that worked >20h/w less likely to agree
Felt nervous retaking	52.73	Asian American students and students who worked >20h/w more likely to agree; men and Pell-eligible students less likely to agree	60.88	Asian American students more likely to agree & International students and men less likely to agree
Anxious while retaking	48.98	Asian American students and students that worked >20h/w more likely to agree; men less likely to agree	56.24	Asian American students more likely to agree & men less likely to agree
Preparing & retaking was too time consuming	22.16	Asian American students more likely to agree	25.78	No demographic differences
Finding the time was challenging	20.22	Asian American students and students who work >20h more likely to agree	n/a	n/a
Students that did not retake exams	% N = 447		% N = 261	
Retaking this exam would not have helped my learning	23.04	Men and Black students were more likely to agree	8.89	No demographic differences
I did not retake because of test anxiety	23.49	No demographic differences	30.08	No demographic differences
Appreciate opportunity to retake exams	98.88	x	97.97	x
All students	% N = 1,337		% N = 1,290	
Lower anxiety on initial exam	89.3	No demographic differences	91.53	No demographic differences

Stayed calmer on initial exam	81.97	Latinx students less likely to agree	86.92	No demographic differences
Studied less for initial exam	20.19	International students less likely to agree	32.12	Students who did not retake exam less likely to agree
Like exam retakes	99.33	x	98.63	x
Prefer regular hours	43.08	Students who did not retake exam, International students, & students who work 1-20h/w more likely to agree	n/a	n/a

Figure S1: Odds ratios for exam score on first attempt (i.e., “First attempt score”) and demographic variables on students’ likelihood of retaking exams in Course 1.

Blue dots indicate positive effects and red dots indicate negative effects, grey line indicates no significant effect. If the error bar overlaps the grey line, the effect is not statistically significant.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

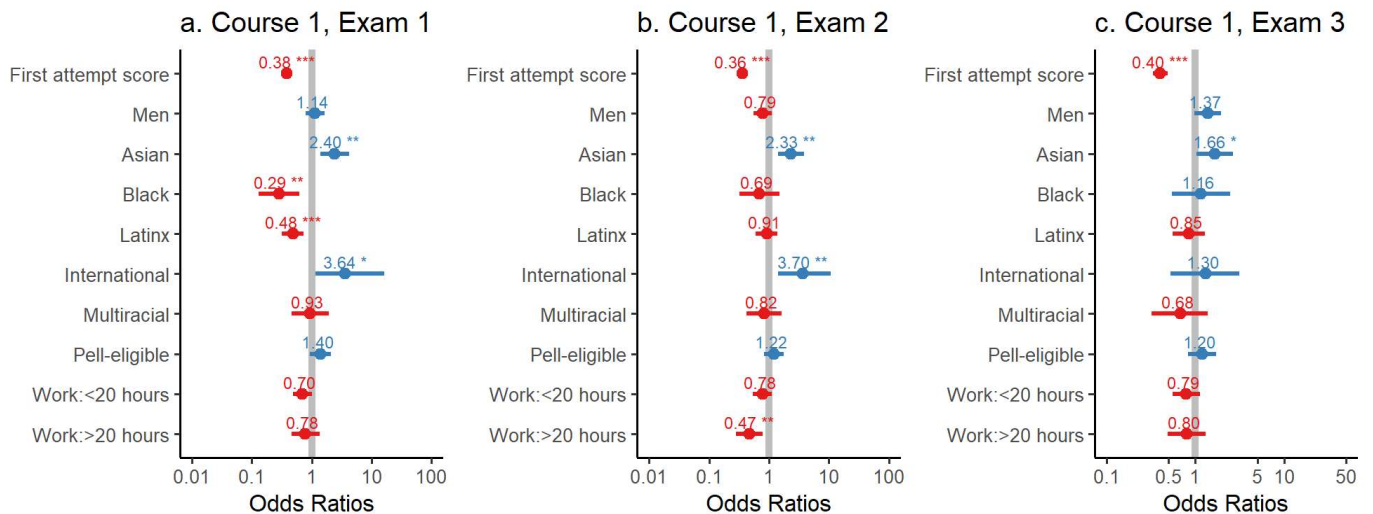


Figure S2: Odds ratios for exam score on first attempt (i.e., “First attempt score”) and demographic variables on students’ likelihood of retaking exams in Course 2.

Blue dots indicate positive effects and red dots indicate negative effects, grey line indicates no significant effect. If the error bar overlaps the grey line, the effect is not statistically significant. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

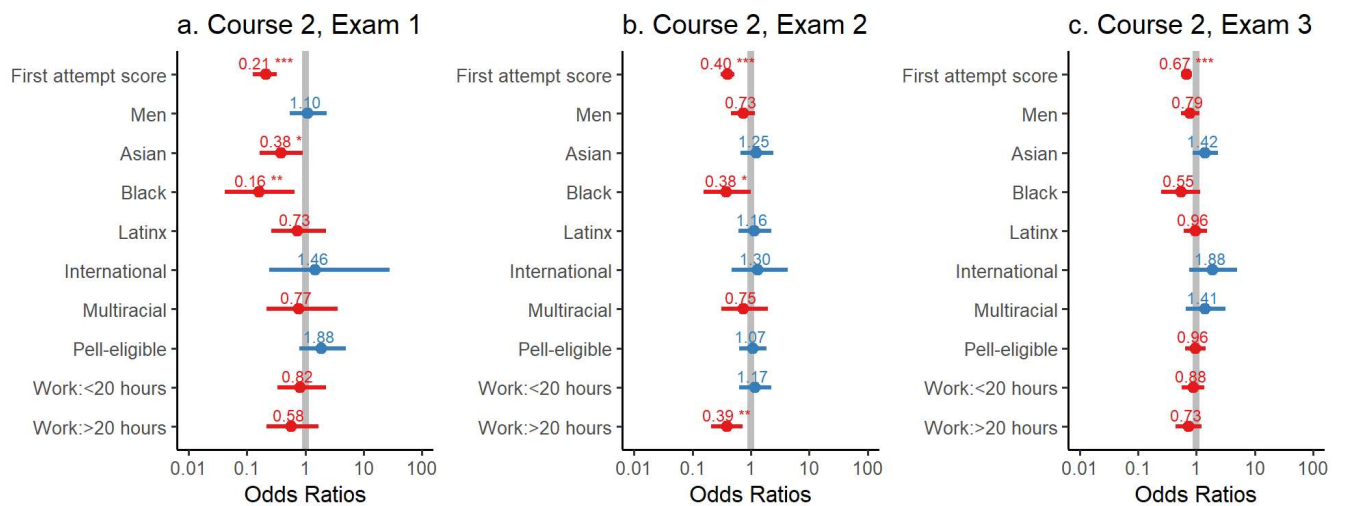


Figure S3: Odds ratios for exam score before a given retake opportunity and demographic variables on students' likelihood of retaking exams in Course 3.

Blue dots indicate positive effects and red dots indicate negative effects, grey line indicates no significant effect. If the error bar overlaps the grey line, the effect is not statistically significant.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

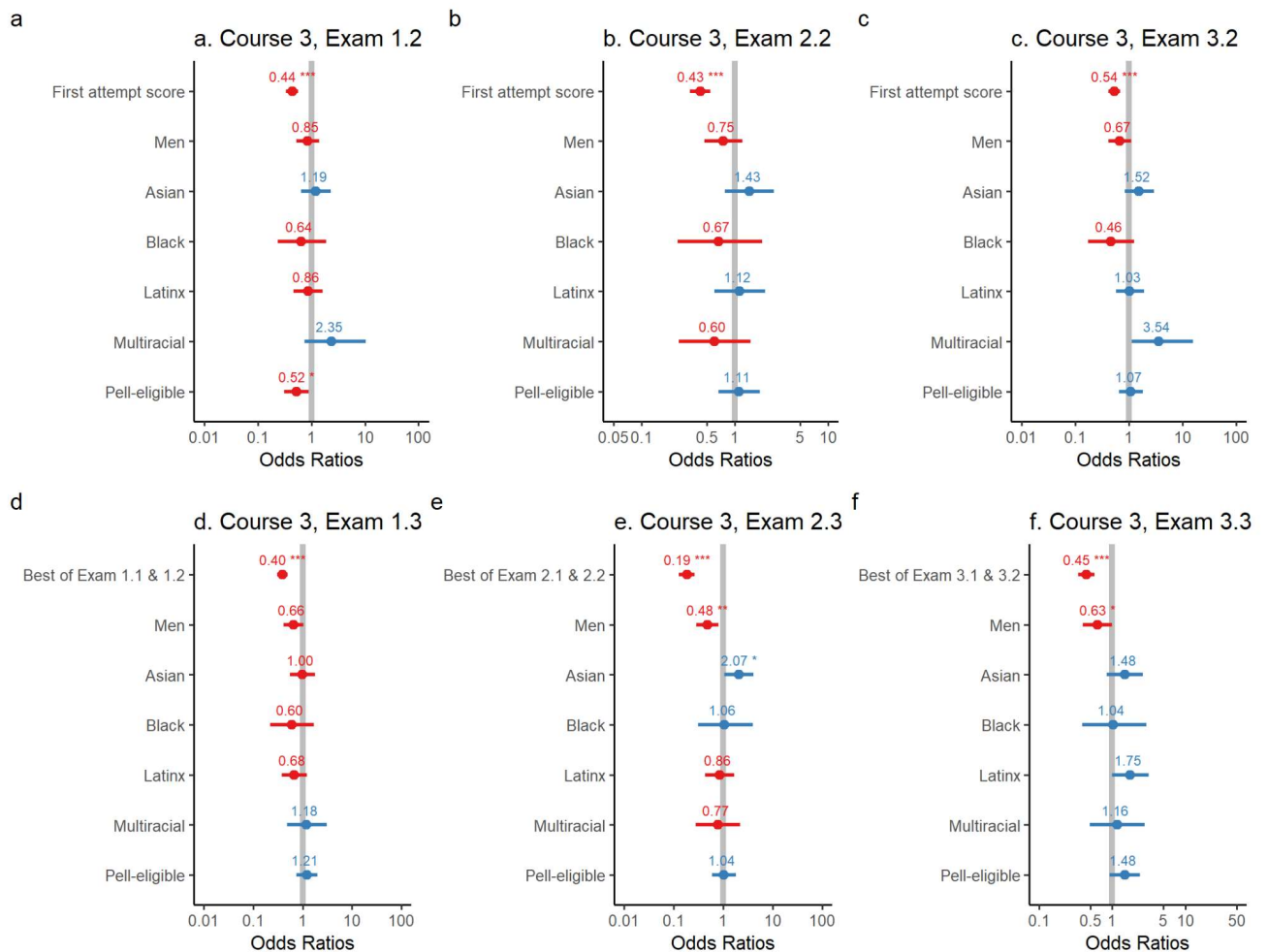


Figure S4: Boxplot of student score on first attempt and retakes by gender.

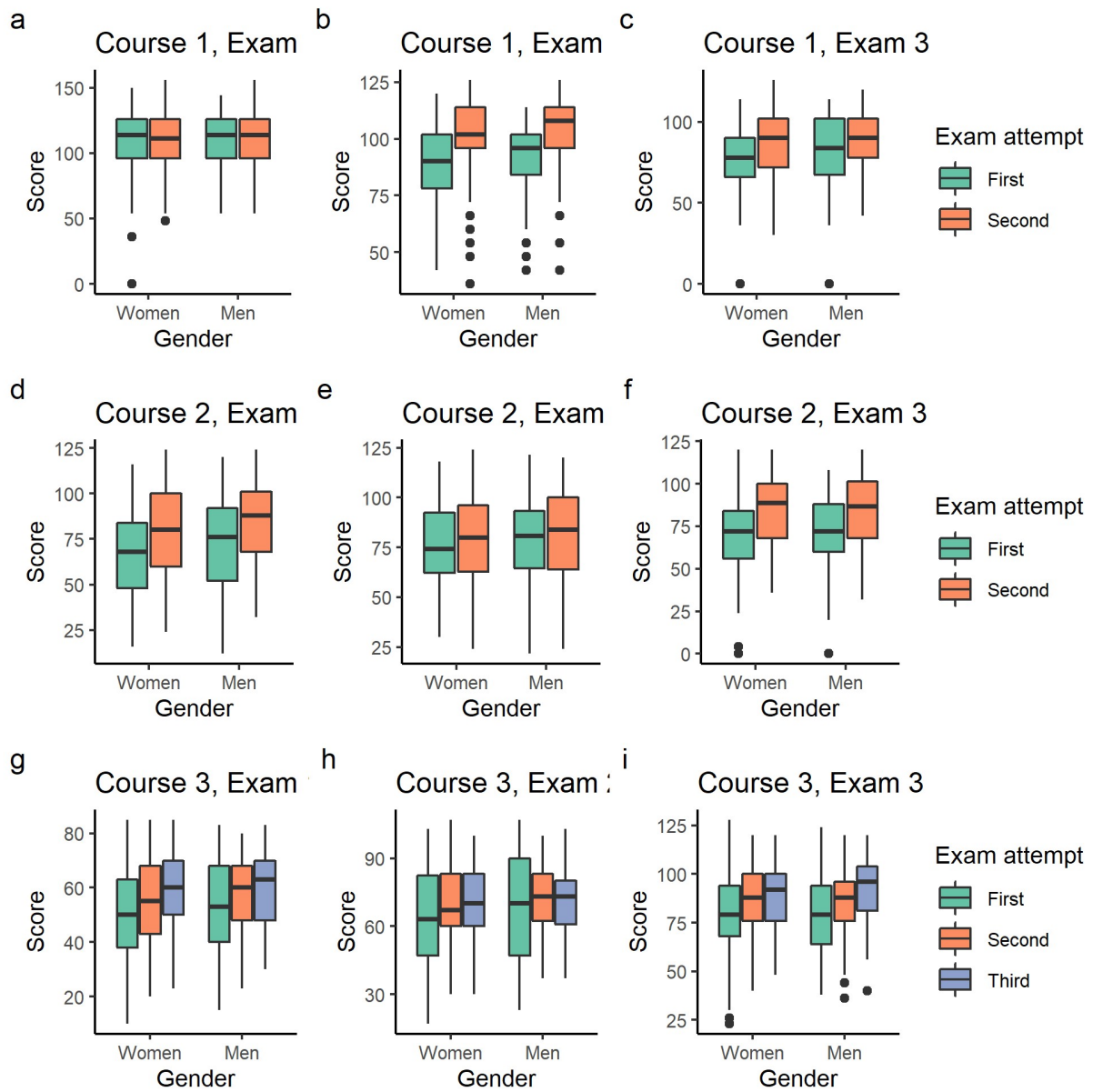


Figure S5: Boxplot of student score on first attempt and retakes by race/ethnicity.

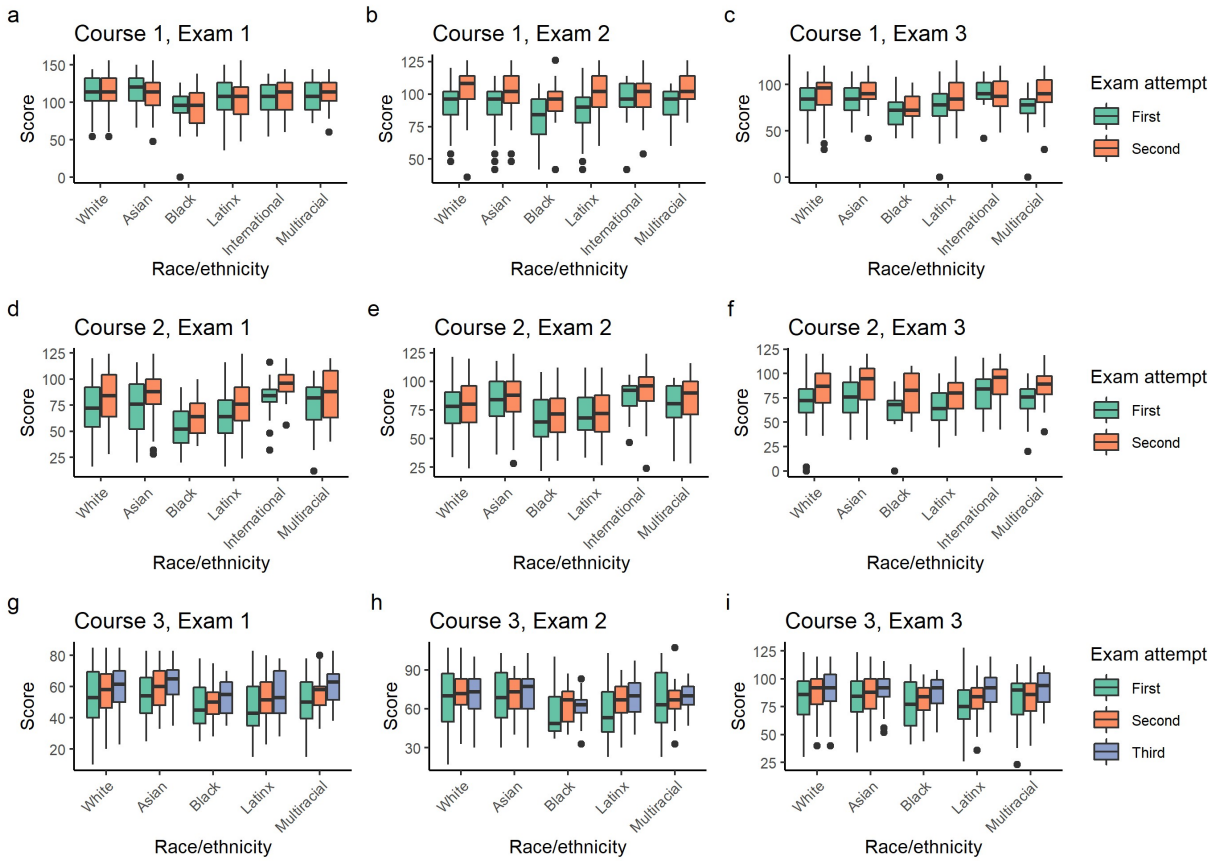


Figure S6: Boxplot of student score on first attempt and retakes by Pell-eligibility.

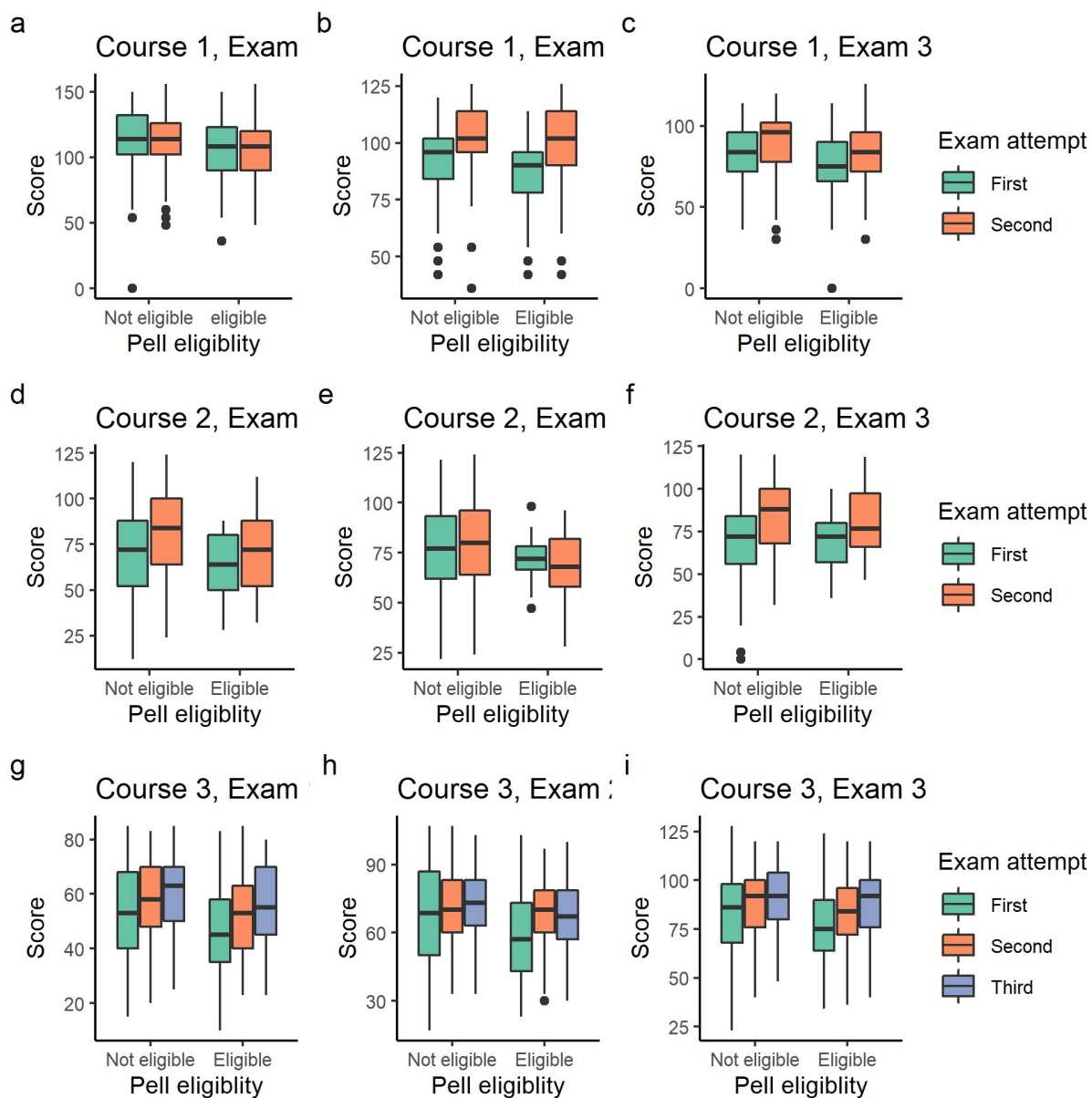
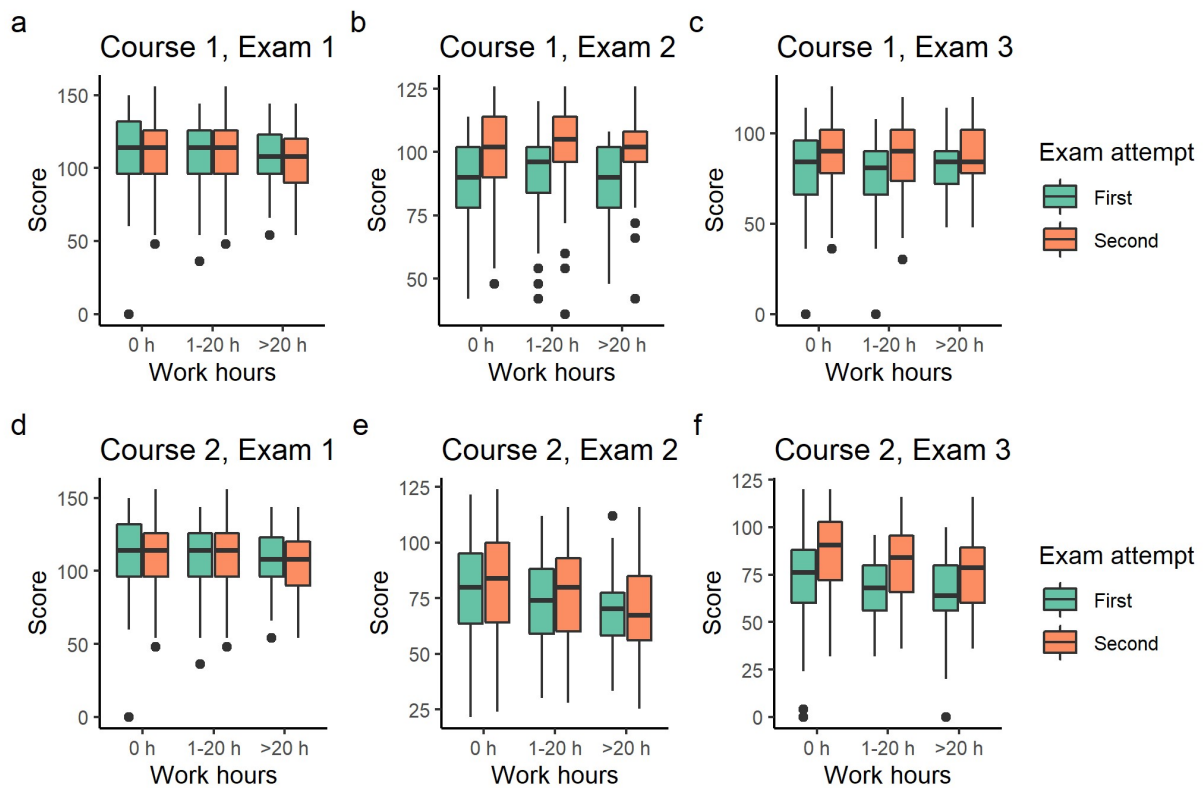


Figure S7: Boxplot of student score on first attempt and retakes by number of hours a student worked a job during the semester.



Survey Questions

Q1 Did you retake exam X for BIOxxx?

Yes

No

The following questions were presented to students who said they retook exam X

Q2 Please explain why you retook the exam in 1-2 sentences. Be as detailed as possible.

Q3 Of the following options, which ones explain why you retook the exam? Please select all that apply to you.

I was not satisfied with my score on the exam when I first took it

I did well when I first took the exam, which encouraged me to try again

I thought I could improve my score on the exam by retaking it

I thought it would help me learn the material better

My friends were retaking the exam, so I retook it as well

I wanted to impress my instructor

I wanted to practice my test-taking skills

Other, please specify _____

Q4 Retaking this exam helped my learning

- Strongly agree
- Agree
- Somewhat agree
- Somewhat disagree
- Disagree
- Strongly disagree

Q5 Please explain how retaking the exam helped or did not help your learning in 1-2 sentences. Be as detailed as possible.

Q6 Retaking this exam reduced my anxiety about taking tests in BIOxxx

- Strongly agree
- Agree
- Somewhat agree
- Somewhat disagree
- Disagree
- Strongly disagree

Q7 Please explain how retaking the exam affected your anxiety about taking tests in BIOxxx in 1-2 sentences. Be as detailed as possible.

Q8 Please think of your experience with exam X in BIOxxx. For each of the following statements, please indicate how true it is for you:

	very untrue	untrue	somewhat untrue	somewhat true	true	very true
I put a lot of effort into studying for the exam retake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt very nervous while retaking this exam	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preparing for and retaking this exam was too time consuming for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finding the time to retake the exam was challenging for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowing that I had the opportunity to retake exam X reduced my anxiety about the initial exam	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I studied less for the initial exam since I could take the exam again	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowing that I had the opportunity to retake exam X helped me stay calm while taking the initial exam	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would like to have such exam retake opportunities in future courses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was anxious while retaking this exam	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would have preferred if the exam retake was scheduled during regular class meeting hours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9 Any other thoughts about your experience with exam retakes in BIOxxx that you would like to share?

The following questions were presented to students who said they did not retake exam X

Q10 Please explain why you did not retake the exam in 1-2 sentences. Be as detailed as possible.

Q11 Of the following options, which ones explain why you did not retake the exam? Please select all that apply to you.

- I was satisfied with my score on the exam when I first took it
- I did not do well when I first took the exam, which discouraged me from retaking the exam
- I did not think I could improve my score by retaking the exam
- Taking exams makes me anxious
- It was too difficult to come to campus the day of the retake
- The process of signing up for a time to retake the exam was difficult
- I had scheduling conflicts the day of the retake
- I am too busy with other things
- I just didn't feel like it
- I planned to retake the exam, but forgot
- Other, please specify _____

Q12 I think that retaking this exam would **not** have helped my learning

- Strongly disagree
- Disagree
- Somewhat disagree

Somewhat agree

Agree

Strongly agree

Q13 Please explain how retaking the exam would or would not have helped your learning in 1-2 sentences. Be as detailed as possible.

Q14 I did not retake this exam because of my anxiety about taking tests

Strongly disagree

Disagree

Somewhat disagree

Somewhat agree

Agree

Strongly agree

Q22 Please explain how your anxiety about taking tests affected or did not affect your decision regarding the exam retake in 1-2 sentences. Be as detailed as possible.

Q10 Please think of your experience with exam X in BIOxxx. For each of the following statements, please indicate how true it is for you.

	very untrue	untrue	somewhat untrue	somewhat true	true	very true
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I appreciated the opportunity to retake exams	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowing that I had the opportunity to retake exam X reduced my anxiety about the initial exam	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I studied less for the initial exam since I could take the exam again	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowing that I had the opportunity to retake exam X helped me stay calm while taking the initial exam	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would like to have such exam retake opportunities in future courses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would have participated in the exam retake if it was scheduled during regular class meeting hours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11 Any other thoughts about your experience with exam retakes in BIOxxx that you would like to share?
