

Supplemental Material

CBE—Life Sciences Education

Canning *et al.*

Supplemental Materials

First Exam Email Manipulations

Control Condition (all performance tiers)

Subject: Exam 1 grade information

Biology 107 Student,

Exam 1 grades have now been posted on Blackboard. These scores are out of 100 points.

Exam overview:

The average score on the exam was XX/100 and the median was XX/100. This is a slightly higher average and median to the scores on the first exam than I've seen in previous semesters.

Here is how your scores on Exam 1 were calculated:

1. There were 15 T/F questions on the exam worth 1 point each and a total of 15 points. All of your correct answers for T/F questions were added up.
2. The 34 multiple choice (MC) questions were worth a total of 85 points.
3. Your exam total was the sum of the values from the MC and TF sections

There will be no scaling or modification of these scores. Please do not ask if there will be a curve – the answer is “no”.

Happy to meet during office hours or at another time to discuss this with you.

Dr. [redacted]

Growth Mindset Condition (above average performance tier)

Subject: Exam 1 grade information

Biology 107 Student,

Exam 1 grades have now been posted on Blackboard. These scores are out of 100 points.

Exam overview:

The average score on the exam was XX/100 and the median was XX/100. This is a slightly higher average and median to the scores on the first exam than I've seen in previous semesters. By now you may have already seen your exam grade in Blackboard. In short, you scored above average. Congrats! Your hard work and persistence has paid off. What I want to do with this email is motivate you to keep up the good work and challenge yourself before the next exam.

My views about learning, exam performance, and doing well in this course:

I believe that every student, regardless of how well they did on this exam, can improve their skills, learn from their mistakes, and be successful in this course. Remember, learning is a process and often occurs over time. Meeting with me in office hours is a great opportunity to deepen your understanding of the material, discuss learning strategies, and create a plan to improve your skills before the next exam. I recommend that all students attend office hours, as everyone can improve and challenge themselves. My hope is that all students will develop the knowledge they need to do well in this course and that all students—even those who perform well early in the semester—will improve and develop greater knowledge and skills with practice. If you're looking for a place to start, let's talk! My office hours are XX.

Here is how your scores on Exam 1 were calculated:

1. There were 15 T/F questions on the exam worth 1 point each and a total of 15 points. All of your correct answers for T/F questions were added up.
2. The 34 multiple choice (MC) questions were worth a total of 85 points.
3. Your exam total was the sum of the values from the MC and TF sections

There will be no scaling or modification of these scores. Please do not ask if there will be a curve – the answer is “no”.

Happy to meet during office hours or at another time to discuss this with you.

Dr. [redacted]

Growth Mindset Condition (average performance tier)

Subject: Exam 1 grade information

Biology 107 Student,

Exam 1 grades have now been posted on Blackboard. These scores are out of 100 points.

Exam overview:

The average score on the exam was XX/100 and the median was XX/100. This is a slightly higher average and median to the scores on the first exam than I've seen in previous semesters. By now you may have already seen your exam grade in Blackboard. In short, you scored between 10 and 20 points below the class average on the exam (don't worry, you aren't alone). What I want to do with this email is motivate you to continue in the class and show you that with some hard work, seeking help, and using the right strategies, you can challenge yourself before the next exam.

My views about learning, exam performance, and doing well in this course:

I believe that every student, regardless of how well they did on this exam, can improve their skills, learn from their mistakes, and be successful in this course. Remember, learning is a process and often occurs over time.

Now, will you make significant improvements on the remaining exams if you prepare in the same way as you did for Exam 1? No. Let me give you a secret to this class-you don't need to be "smart" to perform at a high level in Biology 107. You can work hard and work effectively to master the material. Here's how I know this-I have worked with multiple students every semester who performed poorly on Exam 1, but then turned things around and made 30-40 point improvements on their remaining exams. How did they do it? It wasn't by suddenly getting a higher IQ. Instead, they figured out better ways to learn in the course.

Here's what they have told me about how they made those kind of improvements.

1. They studied every day after class. They stopped cramming and procrastinating and put a specific time on their calendars when they would work on Biology 107 on MWF and some time on the weekends. They had other classes, but putting in an hour a day for four days was enough to allow them to stay up with the class material.
2. If they didn't study with a group of other students before, they started doing so.
3. They looked into concept maps or other approaches to start connecting ideas instead of trying to solely memorize facts
4. They stopped reading their textbook or rewriting their notes multiple times and instead learned how to figure out what they didn't understand after reviewing their notes/textbooks and then fill in the information gaps.
5. They used the Panopto lecture recordings strategically to revisit material that they did not understand the first time in class

Meeting with me in office hours is a great opportunity to deepen your understanding of the material, discuss learning strategies, and create a plan to improve your skills before the next exam. I recommend that all students attend office hours, as everyone can improve and challenge

themselves. My hope is that all students will develop the knowledge they need to do well in this course. If you're looking for a place to start, let's talk! My office hours are XX and there is a guide with some studying tips in Biology 107 in Blackboard.

Here is how your scores on Exam 1 were calculated:

1. There were 15 T/F questions on the exam worth 1 point each and a total of 15 points. All of your correct answers for T/F questions were added up.
2. The 34 multiple choice (MC) questions were worth a total of 85 points.
3. Your exam total was the sum of the values from the MC and TF sections

There will be no scaling or modification of these scores. Please do not ask if there will be a curve – the answer is “no”.

Happy to meet during office hours or at another time to discuss this with you.

Dr. [redacted]

Growth Mindset Condition (below average performance tier)

Subject: Exam 1 grade information

Biology 107 Student,

Exam 1 grades have now been posted on Blackboard. These scores are out of 100 points.

Exam overview:

The average score on the exam was XX/100 and the median was XX/100. This is a slightly higher average and median to the scores on the first exam than I've seen in previous semesters. By now you may have already seen your exam grade in Blackboard. In short, you scored well below the class average on the exam. What I want to do with this email is to provide a bit of a reality check and to not only motivate you to continue in the class, but show you that with some hard work, seeking help, and using the right strategies, you can challenge yourself before the next exam.

My views about learning, exam performance, and doing well in this course:

I believe that every student, regardless of how well they did on this exam, can improve their skills, learn from their mistakes, and be successful in this course. Remember, learning is a process and often occurs over time.

Now, will you make significant improvements on the remaining exams if you prepare in the same way as you did for Exam 1? No. Let me give you a secret to this class-you don't need to be "smart" to perform at a high level in Biology 107. You can work hard and work effectively to master the material. Here's how I know this-I have worked with multiple students every semester who performed poorly on Exam 1, but then turned things around and made 30-40 point improvements on their remaining exams. How did they do it? It wasn't by suddenly getting a higher IQ. Instead, they figured out better ways to learn in the course.

Here's what they have told me about how they made those kind of improvements.

1. They studied every day after class. They stopped cramming and procrastinating and put a specific time on their calendars when they would work on Biology 107 on MWF and some time on the weekends. They had other classes, but putting in an hour a day for four days was enough to allow them to stay up with the class material.
2. If they didn't study with a group of other students before, they started doing so.
3. They looked into concept maps or other approaches to start connecting ideas instead of trying to solely memorize facts
4. They stopped reading their textbook or rewriting their notes multiple times and instead learned how to figure out what they didn't understand after reviewing their notes/textbooks and then fill in the information gaps.
5. They used the Panopto lecture recordings strategically to revisit material that they did not understand the first time in class

Meeting with me in office hours is a great opportunity to deepen your understanding of the material, discuss learning strategies, and create a plan to improve your skills before the next exam. I recommend that all students attend office hours, as everyone can improve and challenge

themselves. My hope is that all students will develop the knowledge they need to do well in this course. If you're looking for a place to start, let's talk! My office hours are XX and there is a guide with some studying tips in Biology 107 in Blackboard.

Here is how your scores on Exam 1 were calculated:

1. There were 15 T/F questions on the exam worth 1 point each and a total of 15 points. All of your correct answers for T/F questions were added up.
2. The 34 multiple choice (MC) questions were worth a total of 85 points.
3. Your exam total was the sum of the values from the MC and TF sections

There will be no scaling or modification of these scores. Please do not ask if there will be a curve – the answer is “no”.

Happy to meet during office hours or at another time to discuss this with you.

Dr. [redacted]

Second Exam Email Manipulations

Control Condition (all performance tiers)

Subject: Exam 2 grade information

Biology 107 Student,

Exam 2 grades have now been posted on Blackboard. These scores are out of 100 points.

Exam overview:

The average score on the exam was XX/100 and the median was XX/100.

Here is how your scores on Exam 2 were calculated:

1. There were 15 T/F questions on the exam worth 1 point each and a total of 15 points. All of your correct answers for T/F questions were added up.
2. The 34 multiple choice (MC) questions were worth a total of 85 points.
3. Your exam total was the sum of the values from the MC and TF sections

There will be no scaling or modification of these scores. Please do not ask if there will be a curve – the answer is “no”.

Happy to meet during office hours or at another time to discuss this with you. My office hours are XX.

Dr. [redacted]

Growth Mindset Condition (all performance tiers)

Subject: Exam 2 grade information

Biology 107 Student,

Exam 2 grades have now been posted on Blackboard. These scores are out of 100 points.

Exam overview:

The average score on the exam was XX/100 and the median was XX/100.

My views about learning, exam performance, and doing well in this course:

I believe that every student, regardless of how well they did on this exam, can be successful in this course. Remember, learning is a process and often occurs over time. Your score on this exam is not an indicator of whether you are “smart” or not—it’s a direct reflection of hard work, perseverance, learning from past mistakes, seeking-help, and using effective learning strategies.

Every semester I see students who make great improvements between each exam. These students meet with me in office hours to deepen their understanding of the material, discuss learning strategies, and create a plan to improve their skills before the next exam. Now is the time to challenge yourself. If you’re looking for a place to start, let’s talk!

Here is how your scores on Exam 2 were calculated:

1. There were 15 T/F questions on the exam worth 1 point each and a total of 15 points. All of your correct answers for T/F questions were added up.
2. The 34 multiple choice (MC) questions were worth a total of 85 points.
3. Your exam total was the sum of the values from the MC and TF sections

There will be no scaling or modification of these scores. Please do not ask if there will be a curve – the answer is “no”.

Happy to meet during office hours or at another time to discuss this with you. My office hours are XX.

Dr. [Redacted]

Table S1*Model Results Without Covariates for All Dependent Variables*

	Exam #2		Exam #3		Course GPA		Course Content Access		Gradebook Access	
	<i>F</i> (1, 412)	<i>p</i>	<i>F</i> (1, 410)	<i>p</i>	<i>F</i> (1, 413)	<i>p</i>	<i>F</i> (1, 413)	<i>p</i>	<i>F</i> (1,413)	<i>p</i>
Condition	1.68	.195	4.11	.043	4.48	.035	5.44	.020	1.54	.216
FG status	9.11	.003	21.70	<.001	20.67	<.001	2.71	.100	3.41	.065
Condition X FG	1.20	.274	3.58	.059	3.09	.080	0.22	.643	0.06	.800

Note. FG = first-generation; Condition was coded: 1 = growth mindset, -1 = control; FG status

was coded: 1 = First-generation, 0 = Continuing-generation.

Table S2*Model Results with URM interaction for All Dependent Variables*

	Exam #2		Exam #3		Course GPA		Course Content Access		Gradebook Access	
	<i>F</i> (1, 409)	<i>p</i>	<i>F</i> (1, 407)	<i>p</i>	<i>F</i> (1, 410)	<i>p</i>	<i>F</i> (1, 410)	<i>p</i>	<i>F</i> (1,410)	<i>p</i>
Condition	2.73	.100	3.37	.067	5.37	.021	4.09	.044	1.23	.268
URM status	8.80	.003	13.55	<.001	4.78	.029	2.24	.135	0.67	.416
Condition X URM	2.80	.095	1.46	.228	2.93	.088	0.14	.708	0.02	.900
Personal fixed mindset	0.58	.445	1.71	.193	0.30	.587	3.04	.082	0.87	.351
College GPA	140.70	<.001	124.80	<.001	290.37	<.001	38.27	<.001	16.93	<.001
FG status	0.05	.827	4.30	.039	3.42	.065	0.02	.893	0.68	.411

Note. FG = first-generation; URM = underrepresented racial/ethnic minority; Condition was

coded: 1 = growth mindset, -1 = control; FG status was coded: 1 = First-generation, 0 =

Continuing-generation; URM status was coded: 1 = URM (Black, Hispanic, Native American, or

Pacific Islander), 0 = non-URM (White or Asian).

Additional Variables Measured on the End-of-Semester Survey

Note: Only 53% of the sample completed this survey. Thus, these variables were not analyzed, given lack of power and disproportional response rates by FG status.

Science Motivation Questionnaire II (Glynn et al., 2011)

Help-seeking (Karabenick, 2003)

Belonging (Muenks et al., 2020)

Evaluative Concerns (Muenks et al., 2020)

Imposter Feelings (Canning et al., 2020)

Personal Mindset (Dweck, 1999)

Mastery Approach (Elliot & Murayama, 2008)

Performance Approach (Elliot & Murayama, 2008)

Perceived instructor warmth and competence (Muenks et al., 2020)

Perceived instructor mindset beliefs (Muenks et al., 2020)