

Supplemental Material

CBE—Life Sciences Education

Gin et al.

Supplemental materials for
*Ph.D. Depression: Examining how graduate school research and teaching
affect depression in life sciences Ph.D. students*

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Copy of interview script

Thank you for agreeing to interview. My name is XXXXXXXX, I am a biology education researcher at [university], and I study ways to improve the experiences of Biology Ph.D. students. My goal for this work is to really just to learn more about you and your experience as a Ph.D. student with depression. I am going to ask you a series of questions. There are no right or wrong answers to any of these questions. Sometimes you may feel like you've already answered a question that I ask. That's OK. Just feel free to elaborate on your previous answer, since I have to ask all of the questions on my list.

Before we start, we sent out the interview consent to you. You agree to consent by participating in the interview. Are we OK to proceed?

I'm going to go ahead and start the interview recording now.

Establishing depression and cause

The goal of this study is to interview students about their experiences with depression, so my first question is, have you experienced depression while in your biology Ph.D. program?

Many people with depression also have extreme feelings of anxiety. Have you experienced extreme feelings of anxiety, either currently or in the past?

Is there a link between your feelings of depression and anxiety? (If Yes: Can you describe this. What tends to come first, anxiety or depression?)

Effect of graduate research on depression

In this interview we are going to ask you questions about how YOUR TIME IN GRAD SCHOOL AFFECTS YOUR DEPRESSION. Then, we are going to ask you about HOW YOUR DEPRESSION affects your time in graduate school. When I ask about your time in grad school, I'm going to ask you questions specifically about your research experience and then your teaching experience (if you have taught). I'd like you to answer these questions just referencing your time in your Ph.D. program before COVID-19 hit. I'm going to ask you about your research experience first.

Could you briefly describe your graduate **research** experience and what you study?

What, if anything, about your graduate **research** experience makes your depression worse?

What, if anything, about your graduate **research** experience helps you manage your depression?

Effect of graduate teaching on depression

Now, I'm going to ask you more about your graduate teaching experience. As I ask you about your graduate teaching experience, please feel free to reference any aspect of your teaching experience - from your relationships with others teaching, to your actual experience teaching.

Can you tell me about the extent to which you have taught undergraduates during your Ph.D.?

What, if anything, about your graduate **teaching** experience makes your depression worse?

What, if anything, about your graduate **teaching** experience helps you manage your depression?

Effect of depression on graduate research

We've asked you a bunch about how your grad school experience has impacted your depression. Now, we would like to switch gears and talk about how your depression has impacted your experience in graduate school.

What are the symptoms of your depression broadly?

How, if at all, do you think depression affects your graduate **research** experience specifically?

How, if at all, do you think depression affects your graduate **teaching** experience specifically?

Recommendations for improving the experiences of graduates with depression

Now we'd like to identify some ways to improve the experiences of Ph.D. students with depression. Your ideas can be targeted at anyone - for example, faculty, graduate program directors, fellow graduate students, etc.

Is there a way that you can think of to improve the experiences of graduate students with depression in the context of **research**?

Is there a way that you can think of to improve the experiences of graduate students with /depression in the context of **teaching**?

Is there anything else you would like to share?

*OK, so that's all I have for you. I'm going to go ahead and stop the recording. Thank you so much for your time. This evening, we will send you a quick follow-up email that asks you questions about depression. There will be no right or wrong answers, but we just want a little more information about how you are feeling right now. At the end of the survey, we collect your information so that we can send you your gift card for participating. **We will send your gift card to you by the end of the week.***

Copy of student-level demographic survey questions

I most closely identify as

- Woman
- Man
- Non-binary/Gender fluid
- Other (please describe)
- Decline to state

I most closely identify as

- American Indian or Alaska Native
- Asian
- Black or African American
- Hispanic, Latinx, or Spanish origin
- Pacific Islander
- White/Caucasian
- Other (please describe)
- Decline to state

What is your parent's highest completed level of education? If you have more than one parent with differing levels of education, choose the higher of the two.

- Did not complete high school
- High school diploma or GED
- Some college but no degree
- Associate degree (for example: AA, AS)
- Bachelor's degree (for example: BA, AB, BS)
- Master's degree (for example: MA, MS, MEng, MEd, MSW, MBA)
- Higher than a Master's degree (for example: PhD, MD, JD)
- Other (please describe)
- Decline to state

Are you an international student?

- Yes (If yes, which country are you from?)
- No
- Decline to state

How old are you?

What is your career goal? (Please list)

Copy of research/teaching-level demographic survey questions

How long have you been in your PhD program?

- Less than one year
- One year
- Two years
- Three years
- Four years
- Five years
- Six years
- More than six years
- I have finished my PhD program

What is the focus area of your research? (e.g., animal behavior, neurobiology, cancer bio)

Do you any have experience teaching undergraduate students? For example, as a Teaching Assistant.

- Yes (If yes, how many courses have you taught either as an instructor of record or as a teaching assistant?)
- No

Copy of depression demographic survey questions

For these interviews, we are interested in the experiences of **all students, regardless of whether they have been formally diagnosed with depression, and regardless of whether they are being treated with depression.** Thus, there are no right or wrong answers to these questions. We are simply trying to learn more about your experience.

During your graduate research experience, in your opinion how severe is/was your depression?

- Mild
- Moderate
- Severe
- Extremely severe
- Decline to state

Have you been diagnosed with depression?

- Yes
- No
- Decline to state

Are you currently being treated for, or have you previously been treated for depression?

- Yes
- No
- Decline to state

If yes, how has your depression been treated? Select all that apply.

- Medication (e.g., antidepressants)
- Counseling/therapy (e.g., working with a psychologist or therapist)
- Other (please describe)
- Decline to state

Table S1. Coding rubric for research-related factors that Ph.D. students reported negatively affected their depression.

Theme	Description of theme	% (n) n = 50
Failures, obstacles, or setbacks during research	Student describes that having a failing/failed experiment or project can negatively impact their depression. This can also include a grant being rejected or the rejection of papers. Student can also describe that they feel like they are wasting time due to the obstacles or failures. This includes a lack of progress in research.	48 (24)
Unstructured research experience	Student describes the lack of structure of research contributes negatively to depression. This could be because research does not have clear goals, next steps, or is amorphous in general. This also include a lack of tasks that can be completed in a short period of time or that there are unclear measures of progress or markers of success in research.	38 (19)
Negative reinforcement	Student describes that they receive negative reinforcement from others in research such as harsh criticism, feedback, comments, or reviews about one's research or performance can negatively affect student depression. This can include the PI/mentor yelling or scolding the student or the PI/mentor being dismissive or condescending.	34 (17)
Unreasonable or overwhelming expectations	Student describes that their PI or lab places too high of expectations on them, particularly related to the progress that they are making. This is often an explicit expectation. However, the expectation can also be implied- it may be lab culture of long hours in lab, # of papers published, etc... Often a student will describe that the inability to meet these expectations contributes to their depression. This also includes students whose depression is negatively affected by the long hours or consecutive days they need to work.	34 (17)
Opportunity to compare self to others	Student describes that graduate school or research presents opportunities for them to compare themselves to others. When students do this, it negatively impacts their depression because they often feel inadequate compared to their peers (e.g., this can lead to feelings of imposter syndrome, but that is coded separately).	28 (14)
Lack of technical support or guidance	Student describes that they do not have adequate support or guidance or a mentor to go to for help related to their research. This often comes up when a student is facing a barrier with a specific aspect of their research project. This would also include a student mentioning little oversight/advising/mentoring. If a student specifically describes a lack of structure or next steps, this is coded as "unstructured research experience." Whereas if a student specifically mentions a lack of mentor or an inability to have questions answered, then this is coded here.	22 (11)
Social isolation	Student describes that working alone, feeling lonely or isolated, or a lack of connection with others can negatively affect their depression. This can be because of the type of research (e.g., field work) or when they're going into the lab (e.g., nights and weekends).	18 (9)
Discrimination/prejudice in the lab or academia	Student describes that there are issues of overt or subtle discrimination or other biases that can negatively affect their depression and their research. This can be from the PI/mentor or others in the lab, department, or university (e.g., committee members). Examples can include sexism, racism, etc.	6 (3)
Research funding	Student describes that a potential lack of funding or not having funding for themselves or their research exacerbates their depression	4 (2)

Table S2. Coding rubric for research-related factors that Ph.D. students reported positively affected their depression.

Theme	Description of theme	% (n) n = 50
Completing small or concrete research tasks	Student describes that concrete/easy/straight-forward tasks are helpful because they can distract from negative thoughts. A student may also describe that checking a box, accomplishing a small task, getting something done is good for their depression.	26 (13)
Working with others	Student describes that interacting with others and collaborating can be beneficial. This can include mentoring or any positive interactions with peers or subordinates in the lab.	22 (11)
Passionate about research topic	Student describes that they are passionate about their research topic or project or that they care about the bigger impact of their work. Student can describe that the overall purpose of their research can alleviate their depression.	18 (9)
Flexibility	Student describes that research allows for some level of flexibility where they can schedule meetings, experiments, time in lab, etc. around their personal/mental health. For example, a student could say that they are able to go to therapy during the day because they can do research around their appointment.	18 (9)
Research progress	Student describes making progress on their project, that their science works, that things in lab are going well, etc. This must include significant progress on their research (as opposed to completing small tasks).	16 (8)
Emotionally supportive PI	Student describes a positive personal relationship with their PI. This can be described as connecting well or having similar personality types or the PI understanding them as a person. Student may also describe that the PI is a good or nice person but isn't specific that it's related to their mentoring. If student describes their PI positively, but provides a specific reason, then it is coded as that reason (e.g., provides enough guidance), but if it is a general liking of the PI, it is coded here. This can also be considered positive emotional or psychosocial support from PI.	12 (6)
Support or guidance from mentor (technical support)	Student describes that having technical support or guidance specific to their research from a mentor can positively impact their depression. This is always someone in research in a position of authority (often a PI), but they can provide research or technical support.	8 (4)
Achievements that can be put on CV	Student describes a "tangible" accomplishment (e.g. receiving an award, getting a publication, passing comps, getting a grant). This could be something that the student could put on their CV.	6 (3)

Table S3. Coding rubric for teaching-related factors that Ph.D. students reported negatively affected their depression.

Theme	Description of theme	% (n) n = 43
Time stress	Student describes that teaching adds to their total number of responsibilities, which can cause an extra stressor that they have to balance with either their research or other PhD program-related responsibilities. This includes if the demand of teaching is overwhelming or if the instructor of the course demands too much time/work from the graduate student TAs.	47 (20)
Negative reinforcement from undergraduates	Student describes that student(s) in their class are rude, disrespectful, not paying attention, disengaged, or disinterested. Student can also describe that they receive negative teaching evaluations (formal) from students or receive negative feedback about their teaching more generally from students (informal).	28 (12)
Personal pressure to teach well	Student describes an obligation to serve students well, to make sure they learn, to teach well, and make sure students understand the material, which can induce stress and exacerbate depression.	26 (11)
Lack of teaching training or guidance	Student describes that not being trained about how to teach, not having guidance about teaching, or not having enough knowledge in the discipline being taught can negatively affect their depression.	16 (7)

Table S4. Coding rubric for teaching-related factors that Ph.D. students reported positively affected their depression.

Theme	Description of theme	% (n) n = 43
Positive reinforcement from undergraduates	Student gets positive feedback from undergraduates about their teaching in the form of a formal evaluation or more informally. Student describes that they get satisfaction out of working with students and seeing them learn. Student can also describe that it is helpful for their depression when they encounter an undergraduate who is passionate about the subject or engaged in their own learning or the material.	58 (25)
Teaching as a structured task	Student describes that teaching is helpful for depression because it allows them to accomplish a concrete task, which can range from tasks such as speed grading to completing the act of teaching the class for the day.	33 (14)
Passion for teaching	Student describes that they enjoy or are passionate about teaching which is helpful for their depression or when they are experiencing depressive symptoms.	30 (13)
Distraction from research	Student describes that teaching serves as something that distracts from their depression, particularly often how their research negatively affects their depression.	23 (10)
Confidence about teaching	Student describes that they know how to approach teaching, are good at teaching, or are an expert in the content knowledge. This is different from a student rating the graduate student highly in teaching, which would be coded as "positive reinforcement."	14 (6)
Positive relationships with others teaching	Student describes that having positive relationships with others who teach, for example with the head instructor or other TAs, can positively affect their depression.	12 (5)

Table S6. Coding rubric for self-reported ways that depression affected Ph.D. students' research or the student as a researcher.

Theme	Description of theme	% (n) n = 50
Lack of motivation and productivity	Student describes that their depression can make them feel less motivated or excited to do their research. This also includes producing fewer publications or research products.	64 (32)
Low self-esteem or overly self-critical	Student describes that they are more self-critical or hyperaware of any issues they may be having. This can also include perfectionism, making them more critical of what they are working on. Student describes that having depression can cause them to doubt their abilities to do science, making the student feel like they do not belong in science, or that they are a fake/fraud, and no one has noticed yet. This often is a result of the student comparing themselves to others or from being critiqued.	58 (29)
Difficulty focusing and concentrating	Student describes that their depression can cause them to feel distracted or unfocused, making it a struggle to pay attention to details.	28 (14)

Table S7. Coding rubric for self-reported ways that depression affected Ph.D. students' teaching or the student as an instructor.

Theme	Description of theme	% (n) n = 43
Understanding of student issues	Student describes that their depression positively impacts them as an instructor because they are more understanding or sympathetic to a student's personal situations, including mental health struggles.	23 (10)
Disconnected or disengaged undergraduates	Student describes that depression can cause them to feel disconnected from students or to have trouble interacting or connecting with students. They may intentionally try not to engage with students during class. This code has to do with the instructor's relationship with the students as opposed to a broad disengagement, which would be coded as "low mood/lack of energy."	16 (7)
Low mood/lack of energy when teaching	Student describes that their depression can cause them to be less energetic or less willing to teach for their students or that their general mood is down while teaching. This code does not have to do with the TAs interaction with students.	14 (6)
Lack of confidence	Student describes that they are less confident in their ability to teach due to their depression or depressive symptoms.	7 (3)
Cancel or reschedule	Student describes instances where they need to cancel class or office hours, reschedule, or ask someone to fill in for them during a time of depression.	5 (2)
Teaching is unenjoyable	Student describes that teaching becomes unenjoyable, a chore, or a hassle, because of their depression.	5 (2)