

UW Academic Challenge and Engagement Study (UW ACES):

Neurobiology

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INTRODUCTION

Research on learning in college shows that learning is profoundly shaped by the goals, practices, cultures, and values of the academic disciplines¹, particularly the disciplinary practices in students' majors. Therefore, if we are to understand the kinds of experiences that students find intellectually rigorous (and, thus, engaging), we need to examine challenge in the major. Understanding challenge in the major is important because at every stage of their college experience, students report that they want to be challenged, that they perform better in courses that are challenging, and that they value classes that stretch their thinking and ask them to demonstrate learning more than they value classes that ask little of them.² Although learning about where students experience challenge is important, asking students to describe challenging learning experiences in their majors requires some prior understanding of how those majors operate. The Office of Educational Assessment (OEA) designed the UW Academic Challenge and Engagement Study (UW ACES) to accommodate these needs.

METHOD

Qualitative methods are recommended when researchers are seeking to understand the complex learning experiences of students, as well as the meaning they ascribe to those experiences³; therefore, we designed the UW ACES to be primarily an interview study.⁴ Using a "citizen science" model, OEA asked departmental advisers if they would be willing to volunteer to interview seniors in their departments who came in to advising to apply for graduation. Advisers are knowledgeable about their academic programs, understand disciplinary practice in their departments, and are trusted by students in the major, so they have the best chance of gathering good information from seniors about their experiences in the major.

Sixty-six advisers from 33 undergraduate programs volunteered to participate. During the 2012-13 academic year, the volunteer advisers asked students if they would participate in brief (5-10 minute) interviews about challenge in the major. If the students agreed, advisers asked them to respond to four open-ended questions, entering students' responses directly into a Catalyst survey form that OEA researchers had designed for that purpose. The questions were as follows:

¹ Beecher & Trowler, 2001; Bransford et al., 2000; Beyer et al., 2007; Donald, 2002; Pace and Middendorf, 2004; Wineburg, 2001, 1991; Neumann et al., 2002; Shulman, 1988; Biglan, 1973.

² Beyer, et al., 2007.

³ Merriam, 2001.

⁴ One participating department asked students to respond to the open-ended questions in writing.

1. What do you consider to be the most challenging work that you had to complete in this major? And by "challenging" I mean doing the work that stretched your thinking the most. This can be anything—a project, a paper, an exam question, homework, something else you did related to the major.
2. What made the project/class/activity challenging?
3. What did you do or learn that enabled you to meet those challenges?
4. What do you think you learned by completing this project/class/activity?

In addition, advisers asked students in what course the challenging work took place and how many quarters they had until they graduated.

Researchers in OEA conducted training workshops in interviewing skills with all participating advisers, provided individual departments with survey customization if required, and monitored all resulting interviews, reporting back to advisers about the interviews they had conducted. By the end of the academic year, departmental advisers had interviewed 1,237 students. Students' responses were analyzed using a constant comparison method⁵, an inductive process designed to let themes emerge, rather than imposing assumed categories on students' comments.

STUDY LIMITATIONS

If we interviewed students post-graduation, they would be likely to identify their capstone courses or their advanced senior-level courses as the ones asking for their most challenging work. However, because we wanted to attach the interview to a time when students would normally see their academic advisers, we interviewed students when they came into the advising office to apply for graduation, which often meant that they were two or three quarters away from graduation. Senior-level courses, particularly capstone or capstone-like classes, are those which students often say are their most challenging and satisfying. Although interviewing students as they applied for graduation meant that we might not gather information about late-senior year courses, we felt that it would be interesting to departments to learn the kinds of challenges that lead to and prepare students for those more advanced experiences.

NEUROBIOLOGY DEPARTMENT RESULTS

The Neurobiology Department was one of the UW ACES' 33 participating departments. Thomas Freng asked 15 Neurobiology students if they were willing to be interviewed for the study, and all of them agreed. This number represents 30% of the 50 seniors who graduated with degrees in Neurobiology during the 2012-2013 school year.⁶

Quarters to Graduation and Where Students Experienced Challenge

In terms of time to graduation, 14 of the 15 interviewees had two quarters left before graduating, and one had three quarters left.

⁵ Merriam, 2001.

⁶ The number of undergraduate degree completions for 2012-13 was provided by Thomas Freng.

When asked which courses in the major had presented them with their greatest academic challenges, students listed a total of three classes, all in Neurobiology, with some students listing more than one course. Those courses were Neurobiology 301, 302, and 401. Thirteen students listed Neurobiology 301 as the site of their most challenging experiences in the major, with six of those students also listing Neurobiology 302. In addition, two students listed Neurobiology 302 as the course that presented them with the greatest challenges. One student noted that Neurobiology 401 was the course that presented the greatest challenges.

1. Students' Greatest Challenges and Why They Were Challenging

Students were asked: *"What do you consider to be the most challenging work that you had to complete in this major? And by "challenging" I mean doing the work that stretched your thinking the most. This can be anything—a project, a paper, an exam question, homework, something else you did related to the major."* Three of the 15 interviewees gave more than one response to this question

In a follow-up question, students were asked: *"What was it about the [activity you just described] that made it challenging?"* Six students gave more than one reason why the challenges they had described were challenging.

Lab reports. Six (40%) of the 15 interviewees said that the most significant challenges they had to complete in the major were lab reports for the Neurobiology courses they mentioned.

Two-thirds (four of the six) of the students who identified lab reports as their most challenging activity said that **writing scientifically without much instruction or prior experience** made lab reports challenging. Two of the students said that the challenge in lab reports was the **amount of time and effort** they required, and two of the interviewees said that the **new material and new ways of thinking** required by the lab reports were what made them challenging.

The following quotations illustrate these categories of response:

- *Exposure to lab write ups and the expectations that went along with them [was my most challenging experience in the major because of the] time crunch,[and my] lack of experience prior to the course.*
- *[The most challenging were the] lab reports including intensive writing, time, thought and planning, and organization. [They were challenging because of my] lack of experience writing scientific papers, not knowing how to organize writing, and the format.*
- *The lab reports for NBio 301 and 302 [were the most challenging]. Tying together class lectures and lab reports without much direction [made them challenging]—lack of direction and lack of specific guidance.*

Conducting experiments in the lab. Five (33%) of the 15 interviewees said that their greatest challenge in the major was doing lab work for their Neurobiology courses.

Two of these students identified more than one reason for why this work was challenging. In explaining what was challenging about doing lab work, four of the five students noted that their own **unfamiliarity with these kinds of lab experiences and the skills required** to complete them made this work especially challenging. Two of the five students also said that the lab work required **independent work and**

thinking, which made it challenging, and one student said that **unfamiliarity with the subject matter** made lab work challenging.

The following serve as examples of these categories of response:

- *[It was challenging] to try to learn and master all the techniques in the lab courses. [It was] intricate requiring a lot of skill and detail.*
- *The lab procedures [were challenging]. Adapting while in the midst of a given project or activity [made it challenging]. It was completely new and on living systems.*
- *Labs for NBio 301 [were my greatest challenge]. [Using] new machinery doing dissections and coming up with experiments and presentations [made it challenging].*

High expectations, exams, and the whole course. In addition to this focus on experiments and lab reports, two students each identified high expectations, exams, and the course itself as their greatest challenges in the major. Interestingly, these six students gave the same reason for why these three aspects of their experience in the major were challenging. They noted that **critical thinking and deep understanding of the information required** were what made these three experiences challenging. The following are examples of these kinds of responses:

- *Preparing for exams [was challenging]. The testing was different than any other course. Graphs were incorporated, translating knowledge. Information was presented from so many angles/perspectives.*
- *The demanding workload for classes and labs and the critical thinking testing [were challenging]. [We had to use] critical thinking in depth and apply that knowledge. It was more than simple memorization.*
- *That first exam in NBio 301 and the expectations of the course—the level to which you must perform—[were challenging]. The content was challenging, and how in depth [you had to understand it] and how [you needed to know how] to apply the content.*

Other. One student noted that reading scientific articles was challenging because it “*stretched my thinking in a new way.*”

2. What enabled students to meet those challenges?

Next, we asked students what enabled them to meet the challenges they had described. Eight of the 15 students identified more than one source of help for meeting those challenges.

Students’ own efforts. Ten of the 15 students spoke of their own efforts as helping them meet the challenges they described, including three who spoke of “*perseverance.*”

Faculty and TAs. Six students spoke of help they had received from faculty and TAs in meeting the challenges they had noted.

Peers. Five students mentioned the help they had received from peers and study groups in meeting the challenges they had described.

Other. Individual students mentioned the following as helpful:

- Applying learning from other classes

- Learning to write scientifically
- Watching videos
- Rehearsing labs

The following quotations serve as examples of what helped students meet challenges in the major:

- *Practice and being thorough.*
- *Working with others, putting in the necessary time in understanding the techniques and material.*
- *Group study, active study, [working with] unique problems and methods of study.*
- *[I learned] how to take advantage of TA's and those who had experience with the reports.*
- *All the TA's and faculty were very helpful, as well as having a week to prepare for lab.*
- *Perseverance and asking for advice.*
- *I talked to classmates and worked with them. I utilized TA's.*

3. What did students learn by completing this project/class/activity?

We asked students what they felt they had learned by meeting the challenges they had described, and 11 (73%) of the 15 interviewees mentioned more than one lesson learned. Several themes emerged from their responses.

Lab skills. Six students said that they had learned laboratory skills from meeting the challenges they had described.

How to write scientifically. Four students said they had learned scientific writing from the challenges they had noted.

New ways to learn and study. Four students reported learning new ways to learn by meeting the challenges they had described.

Deep understanding of course content. Four of the interviewees said that they had gained a deep understanding of course content as a result of the challenges they had met.

Information about careers/the field. Three students reported gaining information about careers and the field.

How to think critically and scientifically. Two students said that they had learned how to think scientifically and critically.

Time management. Two students reported improving time management skills as a result of meeting the challenges they had described.

The following quotations serve as examples of these responses:

- *I learned proper lab technique and etiquette.*
- *[These challenges] helped me understand concepts in class and what a real life lab setting is like.*

- *I learned the basic principles and a passion for dissection, which may possibly lead to pursuing medicine/surgery in the future.*
- *I learned a more effective study/learning strategy.*
- *I am learning how to write scientific papers for future pursuits.*
- *I learned foundational material and advanced study skills, the ability to reason out questions when taking exams.*
- *I have had more exposure to the field and preparation for my career.*

SUMMARY

As the students' comments in the box that follows this section show, strong themes that recurred in students' responses to the questions about challenge were the challenges in conducting labs and writing lab reports. With two quarters left before graduating, many students described these activities as their most challenging work in the major. Furthermore, several students noted that they had not had a great deal of experience or instruction in these areas.

These responses raise questions about the amount of lab work and writing students have likely completed before they take Neurobiology 301 and 302 and where in their curriculum majors get instruction in lab and writing skills. Such questions may be answered with a transcript study of a sample of majors that focuses on courses students typically take before they take the Neurobiology core sequence.

In terms of the help they received for meeting the challenges they had described, about two-thirds of the students pointed to their own efforts. In addition, about a third of the students also noted the help they received from faculty, TAs, and working with peers.

Students noted a range of learning that resulted from meeting the challenges they had described, and that learning mirrored the challenges themselves. They noted learning lab and writing skills, course content, new ways to study, and critical thinking skills, among others.

The agreement among Neurobiology students' responses to the questions about challenge in the major is also noteworthy. First, it suggests that students' experiences in the major are shared. Second, the students' emphasis on research, thinking, and writing skills mirrors the research focus noted on the Neurobiology Department website, indicating that the curriculum is delivering the departmental values to its students.

Finally, students' responses to the UW ACES interview questions suggest that Neurobiology majors felt that the challenges they described were rewarding. This response to challenge is consistent with research on student learning, which shows that when an assignment is challenging for students and when instructors help students meet those challenges, students are engaged in their courses and, therefore, learn more than when coursework is easy.

Two Students' Responses to All Four Questions

Course where greatest challenges occurred: Neurobiology 302

Q1. What was the most challenging work you did? *Producing lab reports stretched my writing and thinking the most.*

Q2. Why was it challenging? *The amount of writing and the depth in the time allotted.*

Q3. What helped you meet that challenge? *How to take advantage of TAs and those who had experience with the reports.*

Q4. What did you learn by meeting that challenge? *That I could write to this amount and depth accordingly and use my time wisely and efficiently.*

Course where greatest challenges occurred: Neurobiology 301

Q1. What was the most challenging work you did? **Snail dissection, which was the coolest thing ever. It was fascinating seeing different parts of the snail brain.**

Q2. Why was it challenging? *[It was] my first ever micro-dissection which is extremely difficult.*

Q3. What helped you meet that challenge? *Very helpful videos and rehearsal was very helpful.*

Q4. What did you learn by meeting that challenge? *[I learned] basic principles and a passion for dissection, which may possibly lead to pursuing medicine/surgery in the future.*

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