

ARTICLE

Early-Career Pedagogical Practice: The Value of Training Undergraduates to Teach

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Pedagogical experiences prior to a career in higher education are limited, particularly for interested undergraduates. We detail here the experience of an undergraduate mentored in pedagogical techniques such as topic and reading selection, assessment creation and grading, and classroom management. Their pedagogical training included co-instructing a course with their mentor. The mentee found the experience to be rewarding, learning the areas in which they excelled and struggled. For the mentor, this was a valuable opportunity to reflect on their own pedagogical choices and techniques. The process provided a new perspective for each of us as we viewed the

course through the lens of the other person. More opportunities for undergraduates to undertake similar roles may strengthen teaching in higher education and grant early career experiences to interested individuals. Though rewarding, course construction and implementation is time-consuming and difficult. Balancing time and effort beyond the class is a required skill, and frequent communication between the mentee and mentor is necessary.

Key words: mentored teaching; pedagogical practice; undergraduate instructor

Quality professorship requires experience within one's field through research and publications, but also through pedagogical practice (Okolie et al., 2020). Robinson and Hope (2013) found that of the 200 randomly selected professors within the State University System of Florida, 78% received no pedagogical training within graduate school and more than 60% never received training before their professorship. For undergraduates considering a career in academia, chances to practice teaching material to others, outside of class presentations or conference attendance, are limited.

In this paper, we describe a course co-taught by an experienced faculty member (mentor) and an undergraduate student (mentee) and describe the mentorship process from course design to implementation. We also describe assessment of the mentee's teaching ability. Based on our experience, we argue that providing opportunities for pedagogical practice to undergraduate students can be a valuable experience for the student and faculty member.

LAYING THE GROUNDWORK

The journey from undergraduate student to co-instructor began with a presentation in an upper-level neuroscience course that led to a series of more personalized coursework. The mentee spent one 15-week semester performing an extensive literature review on the field that would become the focus of our course: neuroaesthetics. During this time, the mentee read over 100 empirical papers, reviews, and book chapters related to that field. We met weekly to discuss the material and to identify overarching themes and questions emerging from the literature. The primary focus of

the mentee's training at this point was to deepen their knowledge of the field.

This work culminated in the mentee's first attempt to create a syllabus schedule - essentially, weekly topics and a reading list appropriate for an upper-level undergraduate course. Since there is no undergraduate appropriate textbook on neuroaesthetics, a major aspect of the mentee's training here was how to impose a logical structure onto a scattered field of neuroscience. The mentor guided this process, providing feedback on the flow of topics as well as the appropriateness of the type, number, and complexity of readings required (Oxford Teaching Ideas, 2021).

In addition to the syllabus schedule, the mentee selected one topic on the schedule to teach as a guest lecture to the mentor's senior seminar course. They created slides, an activity, and discussion questions for the presentation in consultation with the mentor. At this point, we had our first conversation about techniques to increase student engagement. We focused on determining the proportion of class activity to breaks (Paulus et al., 2021), writing questions and stimulating student involvement in discussion (Howell et al., 2014; Neal, 2011), and incorporating active learning components (Michael, 2006).

The response from the seniors was positive. They reported that the mentee had explained concepts clearly and provided interesting examples and activities that made them feel engaged with the topic. We did not formally assess student learning at this point but based on the informal student feedback and the mentor's assessment of the presentation content and the mentee's ability to employ pedagogical techniques, we felt confident to move forward with co-instructing an entire course.

We next spent another full semester modifying the syllabus schedule, designing assessments to measure the course learning objectives, and formulating active learning components to increase student engagement and enhance learning. We were starting with an existing course that serves a specific purpose in the Neuroscience Program curriculum, so there were certain constraints that informed our decisions.

OVERVIEW OF COURSE FORMAT

The course we chose to co-instruct, Topics in Neuroscience (NEUR 374), is a required senior seminar course for the Neuroscience major. The course is designed to provide a culminating experience for majors and minors that applies their knowledge and skills gained from previous neuroscience courses to the exploration of a complex topic in the field.

The course met for one hour and fifty minutes twice a week for approximately 15 weeks. Class time focused primarily on group discussion of the required reading materials, but included interspersed activities that reinforced ideas or allowed students to actively engage with the material.

The faculty who teach neuroscience courses collaborated on the learning objectives (LOs) that guide the program, three of which are initially assessed in Introduction to Neuroscience (the beginning of the major) and again in NEUR 374 (the endpoint of the major) :

LO 1: Students will be able to think beyond single-discipline borders when they attempt to solve scientific problems.

LO 2: Students will be able to access, read and gain insight from the primary neuroscience literature.

LO 3: Students will be able to effectively communicate neuroscience concepts and their relevance to audiences with varying levels of scientific expertise.

The general format of the course as well as the specific LOs were predetermined by the choice to use NEUR 374 as the co-instructed course. The mentor felt that this was appropriate as it constrained the focus of training the mentee in course design. LOs should guide all of the subsequent decisions for a course (Orr et al., 2022); by having those pre-selected, pedagogical training could focus on topic and reading selection, assessment creation and grading, and classroom management.

TOPIC AND READING SELECTION

The mentee chose the field of neuroaesthetics as their topic of interest for their original literature review. As they explored this field, we discussed what features of a topic make it suitable for the Topics course. Referring back to our LOs, the ideal topic is one that is interdisciplinary and has a strong primary literature in neuroscience. Neuroaesthetics is largely thought of as a combination of aspects of cognitive neuroscience and affective neuroscience, but many

disciplines, including the arts and humanities, have significantly contributed to neuroaesthetics as well (Zeki et al. 2020). The topic is inherently interdisciplinary and, as the mentee learned through their extensive reading list, has a broad and deep primary literature to explore.

Through our exploration of the literature in this field, we determined that four fundamental questions remain subject to debate: where does the aesthetic experience originate from in the brain, what external *and* internal factors influence the construction of an aesthetic judgment, what is the temporal nature of an aesthetic experience in the presence of an aesthetic object, and what is the evolutionary origin of the aesthetic experience? Combinations of these questions can raise a fifth question: what, if any, is the *purpose* of aesthetic experiences? Questions like these, and the fact they remain open for debate, required an examination of research beyond cognitive and affective neuroscience and granted students the ability to use their own undergraduate education to tackle these problems themselves.

To the best of our knowledge, no undergraduate-friendly textbooks on neuroaesthetics currently exist, and popular culture books are limited in quantity and educational quality. As such, we relied heavily on primary research articles located using the search term “neuroaesthetics”. Due to the young age of this subfield and interdisciplinary goal of the course, however, not all required readings fit under this term or are considered neuroscience research. The readings represented research in a variety of areas with a number of techniques, ranging from functional Magnetic Resonance Imaging and behavioral psychology to avian field research and literary analysis.

In creating the final syllabus schedule, we focused on the following two pedagogical challenges: 1) how to impose a logical structure and flow onto a complex and vast literature, and 2) how to determine the appropriate number of readings to assign each week.

The mentee returned to their original syllabus schedule to initiate construction of the official design. Almost every week focused on a different subtopic covering research in, or related to, the field of Neuroaesthetics (Figure 1). The mentee organized the subtopics to allow students time to engage with related research questions, while still changing the discussion by introducing new ideas. The mentee was instructed to not change the subtopics too rapidly. For example, when talking about the origin of aesthetic experiences, the subtopic weeks on Human Evolution, Human Culture, and Nonhuman Evolution were all placed next to each other as Week 8, 9, and 10, respectively.

The mentee chose the subtopics to encapsulate the main ideas, theories, and research conducted on aesthetic experiences and aesthetic evaluations, while remaining broad enough to have students engage with LO 1. The mentor agreed that these subtopics gave students the resources they needed to begin to answer the five fundamental questions previously discussed.

The first half of the semester focused on the “what” and “how” of aesthetic experiences. We decided that the best introduction to the topic was through a philosophical discussion of the definitions of “aesthetics”, “beauty”, “art” and “pleasure, and then connecting it to known

Week	Day	Date	Topic	Readings	Assessment Due Dates
0	Wednesday	1/18	Syllabus & Introductions	None	
1	Monday	1/23	What is Neuroaesthetics?	Zeki et al., 2020	
	Wednesday	1/25		None	
2	Monday	1/30	Neuroanatomy of Neuroaesthetics	Brown et al., 2011; Chuan-Peng et al., 2020	Perusall Annotations @ 2:10pm
	Wednesday	2/1		None	Assignment 1 @ 2:10pm
3	Monday	2/6	Cognition & Aesthetics	Huang et al., 2011; Kirk et al., 2008	Perusall Annotations @ 2:10pm
	Wednesday	2/8		Zhang & Zeki, 2021; Leder et al., 2006	Perusall Annotations @ 2:10pm
4	Monday	2/13	Sensory/Motor & Aesthetics	Cross et al., 2011; Ticini et al., 2014	Perusall Annotations @ 2:10pm
	Wednesday	2/15		Iosa et al., 2022; Umiltà et al., 2012; Malik et al., 2017; Kringelbach et al., 2003	Perusall Annotations & Assignment 2 @ 2:10pm
5	Monday	2/20	Hedonic Beauty	Brielmann & Pelli, 2019; Weigand et al., 2021	Perusall Annotations @ 2:10pm
	Wednesday	2/22		None	Perusall Annotations @ 2:10pm
6	Monday	2/27	Neuroaesthetics & the Humanities	Joket & Blochwitz, 2020; Wu, 2016	Perusall Annotations @ 2:10pm
	Wednesday	3/1		Skov & Nadal, 2020	Perusall Annotations @ 2:10pm
7	Monday	3/6	Human Evolution of Aesthetics	None	Critical Reflection Essay 1 @ 11:59pm
	Wednesday	3/8		Gallup & Frederick, 2010; Karama et al., 2002	Perusall Annotations @ 2:10pm
M 3/13 & W 3/15 Spring Break - No class!					
8	Monday	3/20	Human Evolution cont.	Balling & Falk, 1982; Gangestad & Buss, 1993	Perusall Annotations @ 2:10pm
	Wednesday	3/22		None	Assignment 3 @ 2:10pm & Peer Review 1 @ 4pm
9	Monday	3/27	Culture & Aesthetics	Monroy et al., 2022; Yang et al., 2019	Perusall Annotations @ 2:10pm
	Wednesday	3/29		Senzaki et al., 2014; Tang et al., 2022	Perusall Annotations @ 2:10pm
10	Monday	4/3	Nonhuman Aesthetics	Hamilton & Zuk, 1982; Rodd et al., 2002	Perusall Annotations @ 2:10pm
	Wednesday	4/5		Heinsohn et al., 2017; Ritters et al., 2014	Perusall Annotations @ 2:10pm
11	Monday	4/10	Dangers of Aesthetics	None	Critical Reflection Essay 2 @ 11:59pm
	Wednesday	4/12		Steward, 1980; Tsukiura & Cabeza, 2011	Perusall Annotations @ 2:10pm
12	Monday	4/17	Dangers of Aesthetics cont.	Clifford & Walster, 1973; Langlois et al., 1995	Perusall Annotations @ 2:10pm
	Wednesday	4/19		None	Perusall Annotations @ 2:10pm
13	Monday	4/24	Aesthetics & Emotion Regulation	Hermann, 2021; Dingle et al., 2017; Giannini et al., 2013	Perusall Annotations @ 2:10pm
	Wednesday	4/26		None	Assignment 4 @ 2:10pm & Peer Review 2 @ 4pm
14	Monday	5/1	Final Thoughts	None	
15	Friday	5/5			Final Project due by 4:30pm

Figure 1. Course schedule, Spring 2023.

neuroanatomy. As these were senior neuroscience students, they were expected to be familiar with the regions of interest and encouraged to use their previous education to predict the role these regions may have in Neuroaesthetics broadly. This opener laid the foundation for an empirical exploration of function and behavior throughout the course, enhancing the students' ability to engage with LO 2. Agreeing with the argument of Skov and Nadal (2020), the mentee felt that a genuine approach to neuroaesthetics lay beyond an examination of just art. With this, the second half of the semester focused on the origins and purpose of aesthetics in one's life. As the semester approached the second half, we introduced the students to more evolutionary, cultural, and behavioral studies, as well as perspectives from the humanities that dealt more with physical attraction - in line with LO 1.

The mentee was advised that, for a seminar course, students should be given approximately 80 pages of readings per week. Furthermore, to increase the breadth of research students were exposed to in each subtopic, we decided that four primary articles a week was appropriate - two for each class period. The reading list was selected carefully from the 100s of pieces of literature we explored on neuroaesthetics and related topics.

ASSESSMENT CREATION AND GRADING

The LOs for the course guided our creation of assessments. Students were graded on three categories of assessments: reading annotations (assesses LOs 1 and 2), reflection essays (assesses LOs 1 and 2), and a final project with oral and written components (assesses LO 3). Students received grades on multiple items under each of these categories, spread across the 15-week semester.

We chose to provide the readings through Perusall and placed students in "groups" of one (1) so that they could only see their own comments. Students were expected to annotate every reading prior to the in-class discussion, but were only graded on five (5) pseudo-randomly selected throughout the course. Scores for annotations were based on three criteria: definitions of unknown words, summarizations of complex sections, and connections to the topics of the reading.

Two Critical Reflection Essays (CRE) were assigned to students at week 7 and week 11. The first CRE asked students to pick an art piece from the Ross Art Museum (attended the previous week) and explain their aesthetic interaction with the piece using concepts learned in class up to that point. The second CRE asked students to give their stance on the question "Do nonhuman animals have an aesthetic experience?" and then defend the stance with primary research articles. These were graded using a modified version of rubric designed by the neuroscience faculty to assess LOs 1 and 2.

For the final project, students were asked to explore or create an emerging subfield of neuroscience. They were required to detail the main ideas and research findings within this field (i.e., conduct a literature review) and to explore the potential societal and cultural implications of this research. The two main graded components of the final project were a 15-page paper written for an audience of upper-level neuroscience students and faculty and a three-minute TedTalk-inspired video showcasing the most interesting aspect of their topic in a manner suitable for a general audience. Completion of the paper was scaffolded over the course of the semester, such that students received feedback on sections of the paper from the co-instructors and their peers. Final project grading was again based on rubrics created by the neuroscience faculty to assess LO 3.

We had several discussions about the details of the assessments as we developed the course. Key decision points were the use of Perusall and the number of annotations that would be graded, the specific prompts and timing of the CREs, and the timing of the scaffolded assignments and peer reviews for the final project. While many of these decision points were guided by the past experience of the mentor, the mentee's more recent lived experience as a student was particularly influential here. For example, the choice of Perusall for this assessment was largely driven by the mentee's positive past experiences with the application in other courses. Combining our experiences as student and instructor, we were able to space the key assessments in a manner that would allow us to give students adequate time to complete the creative work and ourselves the flexibility to provide meaningful and timely feedback.

After the submission of assignments, we each graded separately, and then compared notes. Students typically received individualized feedback from the mentor and mentee, but in some cases, the feedback was consolidated. Although feedback from the mentee was predominantly on the mark, the process of grading was not always intuitive and adjustments to feedback were made when necessary with guidance from the mentor.

CLASSROOM MANAGEMENT

Based on the mentor's experience leading discussion-based seminars, training in classroom management focused primarily on how to write engaging discussion questions, redirect class conversation when off-topic, and encourage students to participate by giving them many and varied opportunities to share their thoughts. Class time focused primarily on group discussion of the required reading materials, but included interspersed activities that reinforced ideas or allowed students to actively engage with the material. For example, students might be tasked with designing an experiment related to the week's topic or searching for primary articles to answer a question proposed by the instructors or other students.

At the start of the semester, each class period typically began with an open opportunity for students to express major issues or concerns with the required reading material for that day. Student concerns often centered on criticisms with the methodology of the research, but sometimes included a need for an explanation of the methods or results. When clarification on article details was needed, we gave their peers the chance to provide that information first before we answered questions and clarified misinterpretations.

In preparation for each meeting, the mentee prepared discussion prompts to encourage meaningful analysis of the readings. Students were encouraged to ask their own questions and share their own thoughts on the readings, but the discussion prompts ensured that there was a guide for understanding the content and ensured that if students were reticent to jump into the conversation with their own analysis, they could rely on the questions to stimulate and organize their thoughts.

During weekly meetings throughout the semester, the mentor would review the mentee's discussion prompts for the next topic and provide feedback. Initially, we had formatted class meetings to depend primarily on these prompts and so our focus was on writing thought-provoking and open-ended questions about the material. We found within a few weeks that not all of the students in the course were able (or willing) to actively participate in these conversations. We also found that occasionally conversation lulled, which required us to think of additional prompts on the spot. These are common problems in discussion-based courses, so this was a great opportunity for the mentee to consider other ways to engage the students' interest in the topic. This led to some restructuring of the class meetings, starting off with a short refresher of the articles and building in more of the activities we mentioned earlier rather than relying solely on discussion prompts. We found that when students were first engaged with designing an experiment or finding another piece of literature to support a point, they were then more willing and prepared to engage with the prompts.

Additionally, halfway through the course we implemented a change to the Wednesday class periods. We introduced a writing prompt asking students to provide their interpretation of the "main takeaways" of that week's readings and discussions as it pertained to the main topic of Neuroaesthetics. Students shared their written response with the class. By giving them a little time to collect their

thoughts about the week's readings as a whole in writing, the students were better prepared to participate with further discussion prompts. This exercise also helped us highlight similarities and differences in what the students found most important about the material.

Finally, we spent a good portion of our weekly prep meetings debriefing about how the previous week's class had gone. These conversations were critical for helping the mentee understand why certain prompts or activities did or did not work, and what changes might be worth trying to implement in subsequent class meetings. While the topic and reading schedule was set at the start of the semester, the specific nature of class meetings was planned week by week. This approach made the course prep quite time consuming during the semester, but we believe it was worth it for both the mentee and the students. For the latter, it meant that we created a course that was adaptively responding to the students' needs and interests in a timely manner. For the former, it allowed them to continually reflect on the effects of the pedagogical decisions we were making in real time.

LESSONS LEARNED

Kronemer and Yates (2012) found their undergraduate-led course to be a success, and we came to the same conclusion based on the following: 1) the student's informal feedback and their course performance, 2) the mentee's growth in skill and confidence, and 3) the mentor's willingness to try such an experiment again.

Students in Topics were asked to provide anonymous informal feedback on the course topic and instruction. Their comments indicate they found the topic interesting and the required readings and assignments to be useful for engaging with the material. There were no negative comments regarding co-instruction with an undergraduate; most stated that they felt the mentee provided a fun and comfortable teaching environment without limiting the complexity of the topic as a college-level course.

In addition to this informal feedback, we compared their performance on assessments over the semester to look for growth within the course. One notable finding is that the annotation grades trended higher as the semester progressed. This is important because while we only graded five random annotations, the mentee read and responded to every annotation the students wrote over the entire semester. The feedback from the mentee appears to have had a positive impact on the students' annotation skills as later submissions scored higher than earlier ones.

Finally, we compared the spread and average of course grades for this class to previous semesters when the mentor taught the course without a student co-instructor and found them to be nearly identical. We did not go into this process with the intent to specifically learn how undergraduate teaching would influence undergraduate learning, so there are of course many uncontrolled variables to consider here and any conclusions should be drawn with caution. We see no evidence, however, in the formal or informal evaluation of the students that suggests this had a negative impact on their learning.

For the mentee, a junior Biology and Neuroscience

double major, the course was eye opening to the role of a professor in a discussion-based course and the work that goes into course construction behind the scenes. The experience manifested itself in three main lessons: the effort of course creation, the plastic nature of teaching, and the difficulty of grading less objective assignments.

The mentee took care to become familiar with the material of the subfield themselves before course construction even began. This process was a long but necessary step for determining not only the content future students would be required to read but also to prepare the mentee for questions their future students would ask. Some questions asked throughout the course required knowledge of primary sources not assigned to the students. Without the guided literature review, this might have been a challenge.

One of the most important lessons learned by the mentee was how plastic a course, particularly a newly designed one, can be. Despite months of preparation, adaptations were a required part of the process throughout the semester. The extent to which students engage within a seminar course can often be a flip of a coin, particularly in a small class setting or during less familiar topics. Some activities and questions were changed, scrapped, and recreated a weekend before class in an effort to increase student engagement and discussion. We also found it necessary to generate additional discussion questions in the moment to fit the unique interest of the students during the class period. The extensive background knowledge the mentee had gained proved vital in these moments.

The most difficult lesson for the mentee was the process of grading. Though rubrics were made far in advance, attaching a grade to one's ability to accurately convey, or defend, an idea was not as easy as providing the written feedback. The mentee believes that this may be one of the greatest challenges and benefits of allowing undergraduates to teach courses like this. Becoming proficient at staying consistent and fair in grading between students, as well as to not inappropriately expect prior knowledge on the part of the student takes practice. Allowing students interested in a career in academia to learn this process alongside an experienced instructor provides a chance to learn through error while safeguarding the students enrolled in the course.

For the mentor, an associate professor with over a decade of teaching experience, this process was challenging in the best way possible. The mentor has spent a considerable amount of time reading and thinking about pedagogy, but not explaining it to others. It is well-known among cognitive scientists that teaching others is a powerful tool for increasing one's own learning. Teaching about teaching is no exception to that rule. The necessity to articulate *why* certain pedagogical decisions were made or why a particular grade felt more appropriate or why a student might respond more negatively or positively to a particular approach, has certainly strengthened the mentor's own teaching. The opportunity to reflect and engage in metacognition about teaching is one the mentor would welcome experiencing again.

CONCLUSION

Kronemer and Yates (2012) warned that teaching a course

requires the same effort as taking two. We agree with this assessment wholeheartedly. It is likely not suitable for all undergraduates and must be balanced with their academic schedule and other responsibilities.

If one has the time and courage to try it, though, we believe that it can be a rewarding and valuable experience to the mentee and the mentor. It is a chance to question our perceptions of teaching and learning as we view those processes through the lens of another person at a different point in their career. It is an opportunity to make us more thoughtful teachers as we nurture the next generation of educators.

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