Teaching future neuroscientists: Integrating skills and content in graduate courses

Karen Gale, Ph.D.
Interdisciplinary Program in Neuroscience
Georgetown University, Washington, DC.
Objectives of the modifications:

• To make the subject meaningful
• To enhance deep learning
• To promote active learning
• To provide authentic assessment
Case 1: Teaching about types of “memory”

Course: Core Course in Neuroscience (first year), Module on Cognitive Neuroscience

Content: Types of memory (explicit, motor skill, sensory priming, classical conditioning, operant conditioning, working memory)

Skills to be introduced:
- Teamwork and collaboration, researching a topic, teaching and designing a demo for use in class

Old
- presentation by faculty
- discussion of readings

New
- presentations and demonstrations by students
- students work in groups of 3
- student reflective commentary
“Please comment on your group's demonstration. Discuss what worked well and what could have worked better, as well as how you could improve the demonstration. What was the most difficult aspect of the testing? were you surprised by anything? what factors would you have liked to have better control over? You may also comment on any of the demos in which you participated and share your insights or observations.”

• I was surprised at how difficult it was to find experiments that truly tested classical conditioning. It's apparently is difficult to execute these experiments, because the timing is so critical to the success of the experiment. In addition, I was surprised at how much overlap there can be between operant and classical conditioning, in the sense that many of the tasks we thought of to test classical conditioning really were using operants as foundations.

• Does classical conditioning have to be unconscious? Isn't the dog consciously aware of the bell?

• I'm glad that we decided to use cross-modal and uni-modal priming as a way to show two different types of priming, as this provided an opportunity to look into some really interesting neuroimaging literature on this subject. Our word-stem completion task did work and we did see a difference in the two types of priming.

Karen Gale, Georgetown University; November 2005 SfN presentation
Case 2: Teaching about faculty research

Course: Neuroscience Survey Course (fall, first year)

Content: Faculty research, accomplishments and ongoing projects (variety of topic areas)

Skills to be introduced: writing grants, synthesizing literature, developing hypotheses and specific aims, selection of and rationale for choice of model(s), critiquing and responding to criticism

Old
• presentation by faculty
• reading of review articles
• Course paper: review of literature on one topic

New
• faculty present their grant application and explain how aims and hypotheses were developed (many also share critiques).
• students discuss/participate in critique process.
• student paper = research proposal written/re-written with ample feedback from faculty.
Sept 2: Dr. Joseph Neale  
Professor, Dept of Biology  
*Glutamate Models of Schizophrenia and the Role of N-Acetyl Aspartyl Glutamate (NAAG)*

Sept 9: Dr. Guinevere Eden  
Associate Professor, Dept of Pediatrics.  
*Mechanisms of Reading in Deaf Children*

Sept 16: Dr. Chandan Vaidya  
Assistant Professor, Dept of Psychology  
*Integrating brain imaging and genetic analyses of childhood ADHD*

Sept 23: Dr. Anita Sidhu  
Professor, Dept of Biochemistry  
*Synucleopathies in Neurodegeneration*

Sept 30: Dr. Rhonda Friedman  
Professor, Dept of Neurology  
*Learning Beyond Criterion in Aphasia Rehabilitation*

Oct 7: Dr. Stefano Vicini  
Professor, Dept of Physiology and Biophysics  
*Cerebellar Inhibitory Synapses in GABA Receptor Subunit Knockout Mice*
Grant writing challenges and obstacles (student comments)

Observations by the first year IPN students on the anticipated and unanticipated challenges they contended with in the course of their grant-writing assignment for the fall Neuroscience Survey course.

❖ Challenges that were more difficult than expected:

➤ Narrowing ideas to create a testable hypothesis. How to get from the understanding of the existing literature to a meaningful and testable hypothesis (and how to word the hypothesis to best convey the objectives). Using the background literature to design hypotheses that are insightful, interesting, and bound by sound logic.

➤ Biting off a small enough chunk of the question while avoiding the appearance of being too narrow or trivial; maintaining a sharp focus while conveying the broader picture of significance and impact. Figuring out how to make the specific aims sufficiently “specific.”

➤ Formulating the Specific Aims in a concise manner that conveys the specific goals and also the broader concepts.
Case 3: Teaching a skill by doing the skill

Course: *Survival Skills and Ethics* (spring, year 1)

Component: Grantsmanship

Skills: dealing w logistics and technical requirements, writing a clear and compelling proposal, critiquing and evaluating, responding to critiques, discussing evaluations/critiques w other reviewers, responsible conduct (COI, confidentiality, etc).

**Old**
- presentation by faculty panel on the "how to's", "do's" and "don'ts" of grant writing.
- Handouts and examples

**New**
- student and faculty panel to discuss experiences/tips
- students prepare and submit a "mini-grant"
- "field work": student interviews with faculty
- "Grant Clinic" session (one-on-one w faculty)
- Mock Study Sections: students serve as reviewers

Karen Gale, Georgetown University; November 2005 SfN presentation
Student Reflections and observations on the mock study section experience

First, I've got to say that I think it's so strange that people vote on applications they haven't read! That puts a lot of pressure on the reviewers (the primary reviewer especially) to fairly represent the application, which I'm sure doesn't always happen. Although I was skeptical about this method at first, I found that, at least for application whose topics/methods I was familiar with, it was possible to get a good idea of the merit of the application. It was also possible to see biases in the reviewers as well, and to score accordingly. Not a perfect process, but with so many applications, it's probably the only way to go about it.

I was also surprised at how emotional the process can get. For applications I was particularly excited about, I felt somehow emotionally tied to the application--if it didn't do well, I was disappointed. I guess that's some consolation for applicants--it seems like it is possible for a reviewer to actually care about your application. But of course that goes both ways. If you manage to do something to get on a reviewer's bad side (poor writing, etc), it can probably have the opposite effect.
The mock study section was quite an eye-opener. It won’t be long before some of us are sitting in a room and doing this for real and we will have just as much, most likely more, on our plate at that time than we do now. We’ve all been given the advice that our NRSAs will need to be clear, easy to read, and compelling, but nothing could really drive that point home better than actually putting ourselves in the shoes of the people who will be deciding the fate of our NRSAs. I think we understand better now just HOW clear, how easy to read and how compelling they will need to be. Enough to keep people's mind off fatigue, frustration, family obligations and possibly heartburn. I agree with Tom about the time-constraint thing – the system is imperfect but it’s the only system we have and it will continue to make our funding decisions until somebody comes up with something better.

The leaders of our section were really good at being forceful about the rules, the time-constraints, the need to stick up for grants we really believed in etc. They took it seriously, so we did too, and that really made it authentic.
I am recognizing that I had a tendency to be a harsher critic on subjects with which I was familiar. In these cases it was easier for me to pick out holes in arguments or experimental design. I was perhaps easier on those applications that were not in my area of expertise primarily because of my ignorance. I am not sure how I would rectify this problem though. I just hope that other reviewers who have more expertise in the area are able to identify those faults for myself and others who do not have the background in the field.

This experience showed me that you have to be very clear when writing grants. What I would do differently is try to look at the grant from the perspective of someone who knows nothing about the topic or methods included in the grant. I would try to look at it from their point of view when writing a grant to make sure there is enough information included to explain and support what I am proposing to do. I did not attend the post-review discussion. Overall, it was a great experience!

It was interesting to see that many of us changed our scores after hearing someone else's critiques
Case 4: Teaching medical students

Course: Medical Pharmacology,
Content: Lecture on Antischizophrenic Drugs

New element

- Using powerpoint (w sounds and music) to create a fun, brief, self-running show
- Recharges attention in middle of lecture