STATEMENT OF TEACHING PHILOSOPHY
Bradley Voytek, Ph.D.

Overview

As Marshall McLuhan said, "the medium is the message". In academia the traditional message has been the lecture hall itself. When students enter a classroom they enter clutching a well-rehearsed script for didactic education that they have internalized after years of training. They learn a specific style of expression and interaction that is acceptable: "listen and absorb"; "speak when spoken to"; "only answer questions you're sure of"; "will this question be on the exam?" My goal as an educator is to alter these expectations of my students and to engage them in the process of inquiry that is so critical to science.

In a world where any fact can be found in a few seconds of searching on the Internet, many students express the opinion that the didactic classroom has become redundant. I have found that asking questions, rather than answering them, can provide a much richer educational experience for students and educators alike. This dialectic approach to teaching, based on the Inquiry Education method described by Postman and Weingartner, encourages students to engage in discussion and develop critical thinking skills rather than simple fact-absorption.

Many students, myself included, began their undergraduate careers in a digital world. We have learned how to gain access to whatever information we need, when we need it. When learning is viewed as the retention of facts, what is the point of attending a lecture when a few seconds on Google is sufficient to find the fact of interest? I have been on both sides of the educational divide, and I know that we, as educators, have more to offer students than the Internet can provide. We can integrate research with practice, and theory with application. We can synthesize information across a diversity of fields by engaging our students and their interests.

Nevertheless, the plethora of information readily available to students is a reality and I believe education must adapt to this change. Information technologies have caused a great shift in the culture of learning and I have embraced this shift by pushing the boundaries of education into the digital world using blogging and social media.

Digital education

My scientific blog has received over 400,000 hits in the less than three years I've been running it. My online educational videos have hundreds of thousands of views. I have been named one of the top neuroscientists on a variety of social media sites such as Twitter and the popular Q&A site, Quora. My public communication also resulted in me being named as a finalist for the AAAS Early Career Award for Public Engagement with Science. Although these metrics are good, they undermine my true motivation for this kind of education: Outreach.

University faculty, especially at top-tier institutions, hold a particular prestige in our society. Nevertheless, few people have access to such faculty in the real world. The Internet, however, provides much more ubiquitous access to information. For this reason I consider my public writing to be a critical component to my teaching and, more importantly, to my outreach activities. My public writing also helps me sharpen my scientific thinking: answering questions from the public helps me learn how to explain scientific concepts and helps me identify concepts that I don't really understand. In the sciences it's easy to confuse

jargon and having a name for a thing for the understanding of that thing. For example, if I ask, "why does that mutant snake have two heads?" and a herpetologist answers, "because it is polycephalic," they have not answered *why*, instead they have told me that the snake has two heads because it has a condition wherein it has more than one head. If I can't communicate a neuroscientific idea without resorting to jargon it points out the weaknesses in my thinking and understanding.

Because much of the benefits of this kind of outreach are often hidden to quantifiable metrics such as publication counts or citation rates, I am including with my application an experiment: I put out a call to my social networks to attempt to crowdsource a letter of recommendation. That is, I asked my readers to send me a statement—as long or short as they liked—about the impact my writing has had on them (positive or negative). This process itself received a fair amount of attention among the science-writing community, as it is the first of its kind. In the letter I include an unedited collection of the comments I received—some anonymous, some pseudonymous, and some signed—from faculty, students, technologists, clinicians, and the lay public from all over the world.

What's so exciting for me about these events is that, similar to the classroom, they have not always been one-way endeavors. My outreach efforts have lead to connections with Silicon Valley technology leaders; these academe/industry collaborations have been very beneficial for my research, giving me access to cutting-edge ideas and technologies. The novel analysis algorithms I have designed have been improved by conversations with computer science and engineering professionals in private industry. I continue to work with colleagues at these organizations on more detailed computational neuroscientific collaborations that have born fruitful research paths (*e.g.* Voytek & Voytek, *J Neurosci Methods* 2012) that would otherwise be impossible for an academic researcher.

Teaching experience

My teaching style was heavily influenced by the mentorship and guidance of Professors Marian Diamond and the late Jeffrey A. Winer for whom I taught lectures and labs in the Departments of Integrative Biology and Molecular Cell Biology, respectively. Professor Diamond began teaching neuroanatomy before the digital era; she began lecturing in the 1950s, and, at the age of 86, she continues to teach neuroanatomy today. I learned from her the value of the "chalk talk", a style that is more fluid and interactive than slideshows. Relaxing or removing the constraints of a PowerPoint script allows me to shape my lecture according to the size, dynamics, and makeup of the class; if there are more pre-medical students I may include more neurological information or I may need to focus more on cell biology. After my first semester of teaching I was given the Graduate Student Instructor Award by the Berkeley Department of Molecular Cell Biology. I was also nominated in my second semester of teaching, but the department did not want to give me the award in successive years.

While I minimize my use of PowerPoint, I believe it is important not to avoid the benefits that technology provides. I find that, by peppering discussions with new media, students remain engaged. If a student asks a question about a specific neurological disease or psychological theory, for example, I show them videos of patients, examples of experiments, and so on. This lets me show them how a patient with a specific disease looks, acts, and feels, or what psychological experiments look like. By keeping a personal database of videos, sound clips, and websites, I can readily retrieve these media. This interaction also has the side

effect of making every class slightly different, each tailored to the interests of the students in attendance.

From Professor Winer I learned the importance of communicating with my students and listening to their feedback. Professor Winer spent many hours outside of the classroom conducting group office hours. He spoke *with* his students, engaging them actively and persistently about their goals and interests. From him I learned that teaching should not be a one-way street, but rather a rich dialectic between student and teacher. I adopted and modernized this method by incorporating online group instant messaging discussions, blogging, social media, etc. My students have responded positively to these additions, with one student commenting in my final evaluation that I needed to, "tell others about this, please!"

Because each class is different, it is important to assess teaching effectiveness as early as possible. Thus, approximately four weeks into each quarter or semester I invite my students review my teaching and the course. This allows me to modify my teaching strategy mid-course, rather than waiting until the end of the semester to improve. From their feedback I learn what my students want and need; some desire more clinically relevant material while others ask for a more mathematical and methodological approach. I believe that this mid-course evaluation process has been important to my success in the classroom.

Scientific inquiry

Science is a convoluted process with many detours and dead-ends. It does not follow a linear progression with a smooth narrative from hypothesis → experiment → result. Students new to the sciences often do not perceive this complexity and, for that reason, I find it very important to impart this understanding through experience. There are several specific ways that I facilitate this process.

For example, I have observed that students seem to feel that it is easier to ask the expert teacher *for* the answer rather than reasoning out the answer on their own. Thus, my answer to the question, "what is *X*?" is often simply, "what *is* X?" Based upon feedback and student reviews, I have found that establishing early on that it is okay to be incorrect makes students more comfortable in asking questions. It is important to guide them toward *an* answer, even a wrong one! Making errors is a critical aspect of the scientific method. By correcting errors, checking assumptions, and refining hypotheses, scientists move from imperfect knowledge toward a more complete understanding. Thus, we can educate students in the scientific method as *side effect* of our teaching style.

Building off this idea: because guessing incorrectly is an integral part of the scientific method, and collaboration is the means through which much of today's scientific work is conducted, whether my students answer correctly or not I can begin a dialogue with the rest of the class to assess which parts of the logical chain have failed. This allows students to engage the material and—most importantly for modern scientific research—collaborate. By mirroring the process of scientific inquiry in the way in which I talk to my students I can engage them in the scientific method while I guide them through the course material. This form of layered education combined with an inquiry approach gives my students something Google cannot.