Running Head: RESEARCH-LED TEACHING

Introducing the process and content of research into lectures, the laboratory, and study time

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Abstract

Higher education in England is undergoing tremendous changes. Many of the changes are driven by funding, in particular a shift from public funding to student fees, similar to the tuition paid in the United States. Concomitant with the shift in funding is the question of the purpose of the academy, and how the creation of consumer students might redefine such a purpose. In the midst of these changes I here reflect on the role and means of university faculty to create and disseminate knowledge. Many universities state explicitly that research and teaching should be integrated. The concept of research-led teaching has arisen as the concept for which institutions strive. Research-integrated teaching that imparts the cutting edge skills and knowledge that students must graduate with to develop critical thinking skills. Although others have discussed the challenges with implementing research-led teaching at an institutional level, this commentary considers a case study of research-led teaching practice. Here I provide a model of research-led teaching as an example of how to do it. Importantly I wish to stress the reasons a faculty member should implement it, with consideration of the benefits of research-led teaching for the student.

Keyword: research-led teaching; teaching methods; teaching style; coursework; assessment; cognition

What are universities for? Besides being a great question, it is also the title of a recent book by Stefan Collini (2012) that is making waves throughout the United Kingdom. Its timing could not be better given the identity crisis that the academy in England is undergoing. Various governments over that past thirty years have reorganized and reshaped higher education, whether by ending the tenure system during the Thatcher years, introducing fees (tuition) during the Blair years, or tripling the fees during the current Cameron administration. In many ways, however, the universal view of faculty that the university is a place for those who create and disseminate knowledge has not changed. Certainly these issues are not unique to England. The goal of providing students with critical thinking skills is seen by faculty in the United States as central to the mission of higher education (DeAngelo et al 2009).

In the midst of the changes in higher education in England, many universities state explicitly that research and teaching should be integrated. The concept of research-led teaching has arisen as the concept for which institutions strive. Key to research as the creation of knowledge is engagement with the world through critical thinking. Although many might have a stereotype of a researcher in a white lab coat, research is just as central to literature and the humanities as it is to the natural and social sciences. Although there are clear differences in how the disciplines operate, the core mission is the same (Pace & Middendorf 2004). In this commentary I discuss the "learning by doing" approach of scholarly research as a best practice for higher education within the context of teaching the science of psychology, though the approach championed here is just as applicable to many other fields of inquiry. Specifically, I describe the approaches used for teaching a class of 75 second year psychology students in a three-year degree program. The basic idea is to provide examples of how teaching can impart research skills to students by exposing them to the entirety of the process of research and scholarship (Healey 2005; O'Leary 2009). The product of such an education would be the development of essential critical thinking skills (DeAngelo et al 2009) such that the students carry on the process of creating and disseminating knowledge.

As a model for how teaching can be research-led, I focus here on the field of experimental psychology. One primary learning objective for the students is to transform the way they think about the world: In my context, I want them to learn to think like a psychological scientist. I introduce research to students in multiple forms: participation in experiments during lectures and labs and at-home study, providing articles from the primary literature and leading discussions on the interpretation of the data, and providing students with practice writing journal articles in the same manner as scientists, including revision and resubmission. Here I first describe the methods I use to introduce the steps of the research process to the students. I then describe the benefits and challenges that arise in research-led teaching.

There are many steps involved in identifying and investigating a problem. My approach is to introduce students to the following steps common in research: a) the idea, observing phenomena, creating a hypothesis; b) the test, deciding on variables and control; c) analysis, what the results mean; d) the theoretical context for what else is known; e) deciding what the next question or experiment might be; and f) writing the scientific paper, including submission, review, revision, and resubmission. I have adopted ideas from other fields of inquiry to develop the practice described here (e.g., Hoskins et al 2007; Miller 2011; Verran 2009).

To introduce hands-on research to the students and to pique their interest in the topic and to provide the students with an opportunity to become critical observers, I begin with an experimental demonstration. In the very first lecture, I provide an experimental demonstration (detecting changes in a picture) and asking for their opinion on how they are able to do the task. That is, I simply ask them to describe what they think they are doing themselves, a fertile ground for developing a creative hypothesis (McGuire 1997). I then reword their responses as a hypothesis, and provide positive feedback to encourage participation. We then discuss what they think the result might be before looking at the actual data and seeing how a scientist would explain it. Through the discussion, a number of students who might otherwise be intimidated by complicated graphs and statistics have the opportunity to share their simple opinion at first, and then are led to the complex aspects later on. Student feedback noted that they found it illuminating and challenging to be asked to provide and defend their own interpretation of experimental data and to propose a follow-up experiment that would address any questions that had arisen in the lecture, consistent with similar efforts made in other fields, such as the teaching of genetics (Hoskins et al 2007). Furthermore, I found that openly interpreting the data and questioning it leads to increased participation throughout the semester, even from those who admit the content is challenging. As noted by Morton (2009), engaging students in a large lecture is difficult, but those challenges can be overcome by providing an opening for participation.

The collection and analysis of data serve as part of the creation of knowledge. How can the transfer of knowledge creation to dissemination be taught? An essential task is to help the student novices in the field gain expert ways of thinking about the knowledge they have created (cf. Wineburg 2001). The natural next step for a professional academic is to create the written form of dissemination: a scholarly manuscript or research report. The lab sessions all contributed to one full scientific report produced piecemeal, with feedback provided on individual sections. After the first session, which included the running of an experiment, the students first wrote the Introduction and Methods of the report. The students were provided with extensive written feedback before the next lab session. The next assignment required the students to revise the previously assigned sections (not unlike the common requirement to revise and resubmit for publication in peer-reviewed journals!) and to then produce the Results section. The students again received feedback on these three sections, and as before, the students then revised these and provided the Discussion and Abstract for the final report. In most academic fields, all publications undergo peer review, revision, and resubmission before being accepted for publication (Bem 2003). The revise and resubmit process serves as a similar system of ipsative feedback at all levels of my teaching (Hughes 2010), where the students can compare their own performance at two points in time and chart their own improvement. It would be challenging for a novice in the field to register advances in their critical thinking and writing skills from one assessment to the next if the content were to change drastically. By revising, and resubmitting their work, just as professional academics do, the students are able to best assess their developing abilities.

An additional virtual lab method I employ takes place outside the classroom. I ask the students to perform experiments online during the week before the lecture, and those experiments often serve as the basis for part of the lecture (using the CogLab system for participating in e-learning psychological experiments that replicate classic studies; Francis,

Neath, Mackewn, & Goldwaithe 2003). Although they do not receive a grade for online participation, I usually find that approximately 60-90% of the students participate on their own time. Thus, in addition to performing an experiment during the lecture I can also supplement the lecture with an analysis and explanation of other experiments that the students have performed themselves. Once the students take part in an experiment for the first time, they generally find such an experience interesting in its own right as a cognitive game of sorts, and therefore they are self-motivated to take part (cf. Hoskins & Newstead 2009). In addition to encouraging time spent on learning about the course content outside of the lectures, having participated in the experiment before the lecture invariably results in many of the students coming with questions about their experience of the task.

Research-led teaching can certainly be implemented in an analogous manner in other forms of science courses, other fields, and at other levels besides higher education. The key is to start with a discussion of where the questions and hypotheses come from. Next to consider, the methods used to test those hypotheses, which can be described if not demonstrated in the lecture. Providing a look at actual data, or scholarship, produced by such work, and working step-by-step to interpret the results, and provide explanations of them, would follow. For an example from another field, consider a course on history that could undertake such an approach by outlining how one devises historical questions, finds information relevant to the query, and then teaches students how to analyze such results. The unifying theme in these cases from the sciences and humanities is the act of learning by doing such that the students develop habits of critical thinking through actions rather than just words (Wineburg 2003).

From the perspective of the students there are clear benefits to research-led teaching practice in developing the skills they require to be employable upon graduation. From the teacher's perspective, the effort required to teach in a research-led manner pays off in both the high levels of student satisfaction with the courses and with a direct boon to the teacher's own scholarship through excellent observations made by the students. Although many of my examples use psychology as a model discipline in which to incorporate research-lead teaching, these methods can certainly be adapted to other fields of study ranging from literature to history to mathematics. What matters most is bringing the knowledge creation process to the students in the lecture hall, the lab, and all areas of teaching.

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