Brandon Nunn

Montserrat Essay

Fredrick Grinnell’s Everyday Practice of Science

Scientific practice is simple, just as textbooks explain it, isn’t it? A person formulates a hypothesis and designs an experiment to test it, which yields results. This adherence to the scientific method is the idealized, linear approach presented in high school textbooks and taught to the average Joe. Fredrick Grinnell’s Everyday Practice of Science underscores the chaotic reality of scientific practice, unbeknownst to non-scientists and often unrealized by novice scientists. Grinnell stresses the passion that these scientists have, and the ambiguity and uncertainty they face during their experiments on the path to discovery. He also shines light upon the failure that goes unspoken of in textbooks for these scientists during the processes of discovery and credibility. Scientific practice is not how textbooks illustrate it to be, but rather a passionate, messy, frustrating, confusing process that Grinnell displays in his book.

In high school mathematics classes, my teachers taught straight out of the textbooks, and rarely strayed from that material. Although the textbooks were informative with basic knowledge of the subjects, they did not delve into how they reach these conclusions very much, if at all. Years of experimentation and research are crammed into several paragraphs. The information is presented as reliable, and we are forced to hold it as truth. My teachers stressed the correct outcome, not the way in which it was derived, the all-important path in which the actual learning takes place. They would write down proofs on the board and tell us to copy them into our notes, never explaining how and why the proofs are true. The teachers would tell us, “This is the answer and that is how it is supposed to be.” Grinnell tries to demonstrate that the process of finding the proof is oftentimes more important than the proof itself. The process, which includes much trial and error, is never mentioned in textbooks. Having learned from experience, Grinnell shows that the uncertainty of the experiments creates a profusion of failure, often leading one to discover something he was not in search of in the first place. But through these passionate experiments is where the learning really takes place. Grinnell says that everyone should be able to answer all of these three questions: “What do we mean? How do we know? Why do we believe?” (Grinnell 20). Textbooks usually omit the falters and fights that scientists go through to arrive at their conclusions, and thus most students are unable to answer all of these questions.

In high school, I experienced the most learning from a Chemistry class. Science is my least favorite subject, but this particular class was very interesting because it was lab-based. We did not have a textbook, subsequently only performing experiments and writing lab reports. I was not particularly interested in Chemistry; however, it was a very fun and enlightening course. By actually conducting the experiments, I learned a great deal more than I would have just from reading the results out of textbooks. My observed failures and successes yielded information that I thoroughly understood. Sometimes what we were looking for happened, and sometimes it didn’t. Sometimes we observed important findings that we weren’t even looking for in the first place. Even though this class was a hybrid between the scientific method taught in textbooks and Grinnell’s view of everyday practice of science, it gave me some experience of what Grinnell is talking about. I had to be dispassionate and objective during my experiments, but Grinnell says that many real life researchers tend to follow “hunches” and particular self interests. Although my class was close to following the linear model of everyday practice displayed in textbooks, I did learn that you don’t always find what you expect to discover. As Grinnell states, “Everyday practice is ambiguous and convoluted with lots of dead ends.” (4). Most classes in school are focused toward organized structure and adhering to the scientific method to generate successful results, but this class helped demonstrate to me that real life is closer to how Grinnell describes it. That class allowed me to answer Grinnell’s three questions, which is why I gained a very deep, extensive understanding of the material from it.

Textbooks and research articles do not focus on the real people performing these tasks that produce scientific findings. Grinnell provides us with the example of the tension between “Professor Anybody” and “Professor Particular.” “Professor Anybody” is the prototype that is found in textbooks and articles. He is independent and objective. “Professor Particular” is the fascinated, passionate, and subjective researcher that textbooks fail to reveal. These two examples help us in understanding two central activities to science: discovery and credibility. Discovery is not an easy process; it depends on insight, determination and luck. “Professor Particular” can spend many long, arduous and tedious hours with experimentation. He may find what he has hypothesized, although that is very rare. Grinnell tells us that failed experiments are the most common. He also tells us that unexpected results emerge frequently and if the experimenter notices, it could lead to significant conclusions. This is why science is often referred to as serendipitous, because much of its discoveries are exposed by chance. This process of discovery is regularly unmentioned in textbooks and research articles, but it is the gritty, strenuous work that is essential to providing credible information. During the process of credibility, the researcher who made the discovery will work to solidify their findings in order to overcome any criticism from the community that they will reveal their information to. Others need to validate the discovery in order for the findings to become widely accepted. Grinnell provides us with numerous examples of how one goes about discussing their findings with the community. Some scientists hold seminars, have informal conversations, or have peer review by submitting a manuscript to a journal publisher. Unfortunately, during the peer review not everyone can remain objective, and this rift in objectivity sometimes spawns problems. Since the science community depends heavily on reputation, not too many people make errors in credibility judgments because they do not want to damage their reputation. Thus, the process of justifying one’s discovery works reasonably well. “Reciprocity of perspectives makes possible the process of credibility,” (15). This idea of intersubjectivity, Grinnell tells us, enables scientists to reach some sort of agreement on what information is widely accepted as credible knowledge. The community working together to reproduce these findings helps to solidify or reject ideas as they are discovered. This is how the process of credibility works.

It is through the processes of credibility that “Professor Particular” becomes “Professor Anybody.” This is when the discovery claim becomes valid and widely acknowledged by the scientific community. This is what you see published in textbooks and research articles. The entire process of discovery and credibility go completely unnoticed by the non-scientist, yet Grinnell tells us these processes make up scientific practice. Statistics are a part of both the discovery and credibility process. The statistical techniques are more a part of the discovery process than the credibility process. They will not decide any research conclusions, but rather aid the investigator in conducting the experiment. These techniques, whether quantitative or qualitative, can help the researcher to make a discovery claim. The credibility of the statistical techniques used can often be directly related the credibility for the discovery. If the community feels that the statistics used during the experimentation weren’t completely reproducible, then they may not consider the discovery to be credible. Statistics can play a major role in the everyday practice of science.

Scientific practice, as Grinnell would argue, is not fully explained in textbooks and taught in classrooms. It is not easy, and often, one does not find the result he was hoping for, if he finds a result at all. The real, everyday practice of science is complex with many uncertainties. It is full of interest and excitement along with hope and failure. This compilation leads to the processes of discovery and credibility, which are at the heart of science. And at the heart of science is “where intuition and passion meet objectivity and logic.”