Leoul Gezu  
Senior Inquiry Reflection – Revised

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Advanced Lab II: Dr. Nathan Frank

What I learned in development of the DC Plasma Lab Manual: My Senior Inquiry Reflection

BACKGROUND

When I was younger, all my cousins and I spent our summers at my uncle’s house. Back then, he ran his somehow computer-related business out of his garage and his house was brimming with computers, routers, consoles and monitors. I still marvel at the way that LED playground managed to enthrall my attention like nothing else would. I vividly remember the whirr of the hard drives, the cacophonous clicks on the gloriously large mechanical keyboards, the verdant loading bars that prickled my impatience like nothing else and the beep, boops and bops of the modems that taught my cousins and I that silicon was our element.

As I grew up and continued to foster other interests, I found that I was also captivated not only by computers and the things they could do, but by near everything in STEM. I loved it all from astronomy to biology to chemistry to physics, and I chose to pursue a career in engineering, computer engineering in particular, because I felt like that was the way I could contribute and work in any STEM concentration given how ubiquitous computers are. Reflecting on these decisions, it is sharply apparent to me how self-centric all my decisions were. I was considering my needs, trying to figure out what I loved to do and what success would require from me and never stopping to think about what I could do for someone else. The experience of developing this lab manual for my imaginary reader has been an acute reminder of the importance of comprehension, collaboration and efficient communication and has also expanded my considerations when it comes to my own personal goals.

THE EXPERIENCE

The actual experience of performing the DC plasma lab was actually pretty standard. There was nothing that really set it apart from other labs I have done as an undergraduate. We studied some background theory (Paschen curves and the breakdown of plasma), learned how to use the experimental setup (with significant trial and error as always), took some data, performed fits and drew up conclusions that justified success or vindicated failure (usually considering future improvements in the case of the latter). However, it wasn’t always this instinctive. I remember how lost I used to feel in the earlier years of my undergraduate education, tasked with the feat of coming to conclusions about a scientific phenomenon I was just introduced to, with an experimental setup that was usually entirely different from lab to lab, and no arrows in my quiver except for the lab manual developed at another institution, regrettably removing it from all original context and involving looking up word after word in a document that was usually meant for a more experienced audience. Not many things had made me question my love for STEM at that point, but those first few labs really did. Was this what STEM was really like? Constantly trying to make order out of chaos at every turn because considerations hadn’t been made to what language and level of complexity I as the audience would respond to. I realize now that I might have been expecting a little more hand-holding than was standard, but I could still see the need for more straight-forward communication, especially because all my peers felt the same way, and all the students I tutored through Student Success Services always appreciated my efforts to build up complexity, not work down from it. I made a point of developing this project with all these observations in mind, and the following were my takeaways from developing this lab manual for my imaginary reader, working under the assumption that they were in the same place I was when I started.

COMPREHENSION

A few weeks before my first day of college, I remember watching a documentary about Richard Feynman, a physicist who was as much of a legend charismatically as he was for his work in electrodynamics. The Feynman Technique was his personal philosophy on learning and teaching and it basically boiled down to the quote “If you can’t explain something to a child, then you haven’t fully understood it”. His philosophy hadn’t always spoken to me. I used to think intellectualism meant how convolutionally you could think. The more tangents, niche references and abstraction, the better. I know now it is cosmically harder to reduce complexity, not to create it. In development of this lab manual, I tried, to the best of my ability, to explain even the most complicated concepts in the simplest of diction. I found that it was so easy to spot the gaps in my knowledge when I didn’t have those big, encompassing words to fall back on. I realized familiarity never meant comprehension either. Yes, I had read Paschen’s Law for what felt like the hundredth time at that point. Looking at the familiar words and recognizable equations, I had felt like I knew what it was. But when I made a point of not using phrases like “ionization potential” and “emission coefficients” without fully applying their implications, it was considerably more noticeable where my gaps laid and I did a better job of understanding it for myself and explaining it to my imaginary reader.

ASSUMPTIONS

Reflecting on previous manuals that I had personally used, I realized that while I struggled to get the most value out of them, they may have been the perfect manual for another audience. I think every piece of writing is always, consciously or unconsciously, written with an audience in mind. The problem is any author would struggle to mind an audience as diverse as your standard class. We have students from all over the country and world. We have students with a myriad of learning styles, first languages and learning rates. For the purposes of my lab manual, I wanted to make sure I wasn’t making the wrong assumptions about my audience. I wanted to give them the resources and search terms I had to hunt for right where they need them, with instructions to stop and access a resource if a certain concept didn’t make sense. Why? Because these lab manuals are cumulative. I could go on for pages and pages after that, but if my audience was feeling shaky on a certain prerequisite concept already, it would all be for naught. The bigger picture here, and the lesson I took away, is that we must always be vigilant of our assumptions. When assumptions are accounted for, one by one, understanding not abstraction is established along complexity.

STRUCTURE

One of my favorite public intellectuals is Jordan Peterson. He’s quite famous as a modern Western scholar and his insight on learning and structure has carried me a long way. Peterson recognizes, like I believe we all do, that there is a rate of learning that hurts. I think we all know that sinking feeling all too well, when you’re completely overwhelmed by the unknown in a situation and your brain just shuts down. Peterson also recognizes that we observe knowledge in structure, seed by seed almost. You start with your ABCs, then your words, then your phrases, sentences, paragraphs, and whole books and anthologies. Every time we learn, however, our knowledge structure transforms. Previous connections are torn down, and new connections sprout all over the place. If you get the pace just right, learning can be the most magical feeling in the world. It feels empowering and not overwhelming. However, when too much novelty is being opened (when assumptions have gone awry or the pace is off), the chaos that manifests is discouraging, not exhilarating.

Overall, I recognized that my responsibility as the author of this lab manual paper is to assist my reader in creating that structure. As mentioned earlier, one way I’m already doing that is by being cognizant of my assumptions to allow my reader to self-determine their pace. That way, overwhelm becomes a marker to revise, not surrender. Along with that, I make a point about maintaining structure in the lab manual paper for my reader especially in the form of the consistent and ample use of physical structure and wording through margins and indentation.

PERSONAL GOALS

Finally, I have come to the realization that I might have a passion for this. I found myself really enjoying teaching this material, even if it was to an imaginary reader. I hadn’t really thought much about a career in teaching so far. My first encounter with imparting my knowledge, as I mentioned earlier, was working as a tutor in Student Success Services. I started in tutoring last fall, first for just chemistry. Slowly, I started tutoring physics as well. It had been a while since I took those classes, so I had absolutely no verbatim to fall back on. I couldn’t fool myself into thinking I understood something because I had these struggling students looking to me for guidance and I had to somehow explain these concepts to them in the most straight-forward way possible.

Every single student I have ever tutored has went up at least one letter grade after they started working with me and I owe it all to assessing assumptions, using the Feynman technique and establishing structure to always build up to complexity which I only realized when I put it into writing in this reflection.

This assignment has planted the seed within me that may sprout into a career in education sometime in the future. My next three-five years have been predetermined since I am going straight to graduate school. I also think I need to explore a bit of industry to round out my experience as an academic and an engineer. Seeing how things go, I hope that I’ll get more opportunities to practice these techniques and develop as an educator. Maybe someday, I’ll get to apply the lessons here in my very own classroom.