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From: STUDENT
Subject: Investigative Report on Writing in Physics (REWRITE)
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The purpose of this report is to present the findings of my research regarding writing done by university physics professor.

Introduction and Objectives

The intent of the professional development project is to determine the types of writing that pertain to a career path that interests me. I chose to delve into the world of academia, researching the writing requirements of a university physics professor. This project is formalized in this report and contains a discussion of the research method and results. This report also highlights the writing patterns present in this profession. The information gathered was integral to understand the litany of responsibilities of my desired occupation. These responsibilities include teaching, research, and administrative duties. Due to the varied daily tasks, effective time management and flexibility in communication styles are important skills to succeed in this profession. This report is not only useful to those who wish to become a physics professor but also to other disciplines where the position has to balance teaching and research.

Research Methods

The research for this project was conducted in two phases. First, a preliminary search was done to find resources that described effective writing in the field of physics. Second, an interview was conducted. From this interview I acquired writings samples in order to analyze trends in technical communication for a university physics professor. A large majority of the information regarding the requirements to obtain the position were picked up through conversations over the years with members of academia and were reinforced by the online research I did.

Starting with the knowledge that publishing papers was an important aspect of rising the ranks of academia I began researching how to write these papers. I first found a guide from Saginaw Valley State University (SVSU) that described the amount and type of writing that physicists have to do. The importance of knowing one's audience for writing papers was emphasized here. This emphasis was explained in the context of the difference between writing papers to be published versus writing informal documents to inform others about planned research or past results. Now having confirmed the importance of writing and publishing papers I began looking for a guide that laid out exactly how to write these papers. This brought me to an exhaustive guide available on the University of Regensburg's physics page that described this process and the different formats these papers take. The formats discussed on this website included formal journal articles as well as the professional correspondence needed to have these articles published. This research showed the importance of adhering to particular guidelines for each type of writing that physicists have to do. If a document is not in the proper form, it is not likely to be considered seriously and possibly not even read.

The final piece of research was conducting an interview with Dr. Gregory A. Benesh. Dr. Benesh has been a university professor at Baylor University for more than thirty years. He has participated in a variety of research projects at Baylor as well as some at the University of

Oregon and Cambridge University. His undergraduate work was done at Rice University, and he graduated in 1975 with a B.S. in physics. He earned his M.S. and Ph.D. in physics from Northwestern University in 1977 and 1980, respectively. After becoming a professor at Baylor, he took advantage of the opportunity to earn a M.S. in mathematics completing it in 1992. Dr. Benesh also served as the department chair for physics for nearly ten years.

From this interview I acquired three recent syllabi he had written. These syllabi were for three of the four core classes that make up the junior level curriculum in physics. Taking these syllabi I performed a genre analysis. In this analysis, I looked for common patterns that would grant insight into what is important to communicate to students. Taking the perspective of a professor was enlightening in this analysis because it juxtaposed my current position as a student. In this role it was also important to think about what information was most relevant to students. Just as how some professors or other researchers won't read a document if it's not in the proper form, students will likely disregard information that isn't easily presented to them. In addition to the need to be in a particular form, comparing syllabi to research papers again showed the need of writing concisely and keeping things as short as possible. This need to write efficiently as a physics professor manifests itself in syllabi. Though the obtained syllabi were all from Dr. Benesh, his decades of teaching experience led me to believe they were a good indicator of the components of all physics syllabi.

Discussion of Findings/Results

It is first useful to note an important distinction between two types of university level teaching positions. The first is a tenure-track position which requires researching and publishing. The second is a non-tenure track position which is generally speaking only a teaching position. I am interested in a tenure-track position. University professors in physics functionally have two jobs. One is to be a teacher and the other is to be a researcher. For these two jobs the writing differs greatly. The former requires a large variety of writing and is less formal. The latter is centered on one format and is quite formal.

As is evident through Dr. Benesh's qualifications a substantial amount of education is required to become a professor. After obtaining an undergraduate degree one enters graduate school to earn a Ph.D. While in graduate school one has their first experience being a teacher. The vast majority of physics graduate students will become teacher assistants (TAs) and be assigned to teach three sections of a freshman or sophomore level laboratory (lab) course. These lab courses are companion classes for large lecture classes. Teaching these labs requires about fifteen to twenty hours a week with grading comprising about three hours. While it seems like a small time commitment it is extremely important to remain aware of the full course-load of classes one is taking and balance the two responsibilities. The only writing that is required for this initial teaching position is writing corrections for the students on their lab reports. These corrections are usually short comments that point out flaws in physical reasoning.

While still in graduate school but after a couple of years of coursework TAs sometimes will transition into becoming research assistants (RA). Research assistants no longer teach classes but conduct research to assist projects that professors at the university are working on. This research itself requires a more formal approach to writing than one did as a TA. Often research requires complex calculations or modeling physical situations. This is done by writing computer code.

This is a common non-traditional form of writing that is vital to physicists. As an RA one will begin writing papers with the intent of publishing them. Since physicists at this level generally don't work alone this writing involves collaboration and communication to ensure that the correct emphasis and physical reasoning is included. The guide from SVSU further emphasizes this by explaining how concise titles and detailed summaries are important to get to the point quickly and efficiently. A particular example from this guide is that due to the large volume of published papers it is important to be as clear as possible when writing summaries because physicists often don't have time to sift through a long paper to find its relevance and will often only read the headings or the beginning of the summary. This notion of conciseness was reinforced through my genre analysis which revealed syllabi tend to be brief being only one page long and having only three main points. Another type of formal writing that takes place at the graduate level is the writing of a dissertation which is required to complete a Ph.D. This is an exceedingly long document that chronicles the research one did to make a meaningful contribution to the field of physics. Typically this research refers to a project that begins when one is in their first or second year of graduate school. Sometimes part of the dissertation can be multiple papers that one has written such as was the case for Dr. Benesh. Though this project appears to contradict the concise nature of physics writing, it is in line with the need to adhere to a specific form. Many of the dissertation writing requirements center on proper citations and proper formatting. The length of the dissertation is also mitigated by the final defense one has to do at the end. When presenting the final dissertation one has to be concise and clear in their explanations to be awarded the final degree.

The papers intended for publishing discussed briefly above become even more important once becoming a university professor. To become tenured at a university requires publishing multiple papers and remaining at the university for a designated period of time. These requirements are laid out when accepting a university position. Papers to be submitted to physics journals have a consistent format. They begin with an introduction that outlines why the research matters followed by background that is needed to understand the research. After that the research is discussed in a theory section that describes the methods used and results as well as any specific parameters needed if someone wanted to replicate the results. Finally the research is wrapped up in a conclusion that often suggests further investigations or potential implications of the research. This format was described to me by Dr. Benesh and further discussed in the University of Regensburg writing guide. This writing guide stressed making sure the content of the paper lines up with the goals of the journal that one wishes to submit the paper to. For example there is an expectation difference for the breadth of one's work when submitting to a hard-science journal such as the *European Physics Journal Series* versus submitting to a soft-science journal such as *Physics Today*. One trend Dr. Benesh noted was that when he started the field was strict about using the first person so the third person was exclusively used but that has relaxed over the years. Also after acquiring tenure writing becomes episodic. This means that writing papers or compiling research results is often dictated by when one can do the experiments to have something to write about.

Once becoming a university professor not only does research requirements increase but also teaching responsibilities. The teaching side requires numerous flexible styles of writing with varied audiences. Teaching a class requires two things, a syllabus and lecture notes. Syllabi are written for the students and provide information regarding the class. From my analysis of Dr.

Benesh's syllabi I found that their main focus was on outlining a schedule of content to be covered. This focus communicated the need to be organized and punctual. Lecture notes are prepared notes used by professors to teach classes. These are written solely for the professor to remind themselves of the material for that day and often included a substantial amount less writing when compared to what is actually spoken in class. This type of writing is least reflective of the need to adhere to a particular form. Though there is no external body mandating a particular form, each professor has their own way of writing these notes so they are most effective in teaching. This does highlight the need to write effectively, this allows the professor to teach more efficiently by being able to easily read their notes and convey the information. Writing demanded by administrative duties adds to the menagerie of writing styles a university professor must be well versed in. This writing usually comes in the form of recommendations as a result of being on committees. There are committees for interviewing potential teachers, assessing new teachers, revising course curriculum, evaluating budgets, planning events, investigating academic dishonesty, and many more.

All these writing patterns reveal to show the need to give information effectively and concisely. It is also extremely important to adhere to the form of a particular type of writing. Maximizing efficiency is the primary goal of all of the writing types for physicists.

Conclusion

My research informed me of the litany of responsibilities that university physics professors have. And that with these responsibilities comes numerous different writing styles and formats. Not only did I learn about the different forms of writing but the significance of writing well. Grammar and sentence structure is something in particular that Dr. Benesh noted was lacking at the graduate level. Learning how to write correctly is of utmost importance to succeeding in the field. This is something I know I will need to continue to improve upon to reach the upper echelons of academia. Writing effectively is extremely important in the current information age. New discoveries are happening daily in physics and to be able to keep abreast on these updates it is paramount for everyone in the field to write concisely and efficiently so that their research can help and inform others.

References

Huang, Ming-Tie. "Why Writing Matters in Physics." *SVSU*. SVSU Physics Department, n.d. Web. 03 Feb. 2016.

PHY 3330. Intermediate Electricity and Magnetism. Taught by Dr. Greg Benesh. Baylor University. Spring 2015.

PHY 3372. Introduction to Quantum Mechanics I. Taught by Dr. Greg Benesh. Baylor University. Fall 2015.

PHY 3373. Introduction to Quantum Mechanics II. Taught by Dr. Greg Benesh. Baylor University. Spring 2016.

"Writing Papers in Physics 101." University of Regensburg. University of Regensburg Physics Department, n.d. Web. 03 Feb 2016.

Appendix

1. Interview notes (4 Pages) – Dr. Benesh
2. PHY 3330 Syllabus – Dr. Benesh
3. PHY 3372 Syllabus – Dr. Benesh
4. PHY 3373 Syllabus – Dr. Benesh