University of WYoming Department of Physics & Astronomy Program Outcomes 2010–2019: What Recent UW Graduates are Saying

February 19, 2020

1 Introduction

An electronic survey was used to collect data from UW Department of Physics & Astronomy graduates, both bachelors and master's and PhD degrees, from 2010–2019. This report concentrates on bachelor's degree recipients. Approximately 90 bachelor's degrees were awarded over that 10-year survey period. There were 36 responses from graduates between 2010 and 2019: 24 bachelors, 4 masters, 8 PhDs. The 24 bachelor's degree respondants implies a 27% response rate. There were approximately 55 master's and PhD degrees awarded over the same period.

Respondants rated their satisfaction with various aspects of the degree program and their overall satisfaction with their degree, from the perspective of their first job after leaving UW. Graduates were asked to rate their perceived level of preparation relative to their peers in areas such as fundamental physics understanding, use of laboratory equipment, and use of software tools. On most questions, 1=poor, 2=fair, 3=average, 4=good, 5=excellent. Below is a graphical summary of the graduates' responses, along with advice to future students.

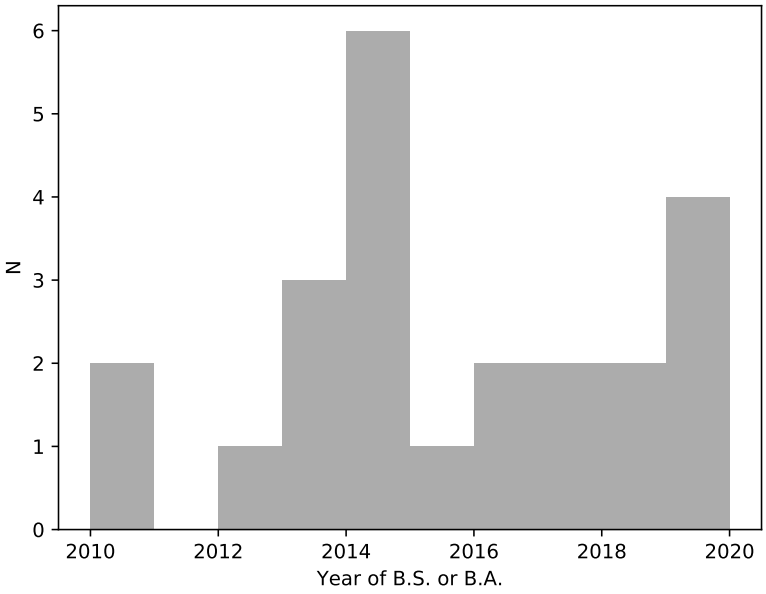

Figure 1: Year of Bachelor's degree.

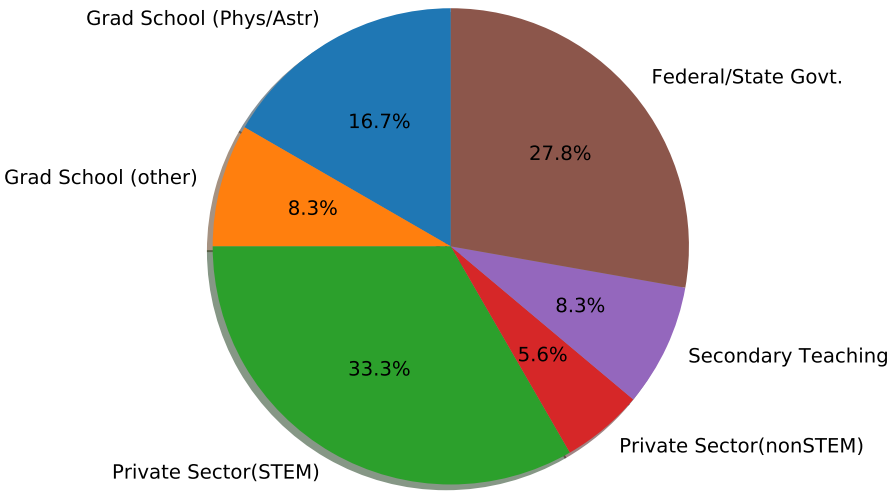

Figure 2: Current employment description, including bachelors and graduate degrees. Options for *Active Military* and *Unemployed* received zero responses.

2 Survey Results

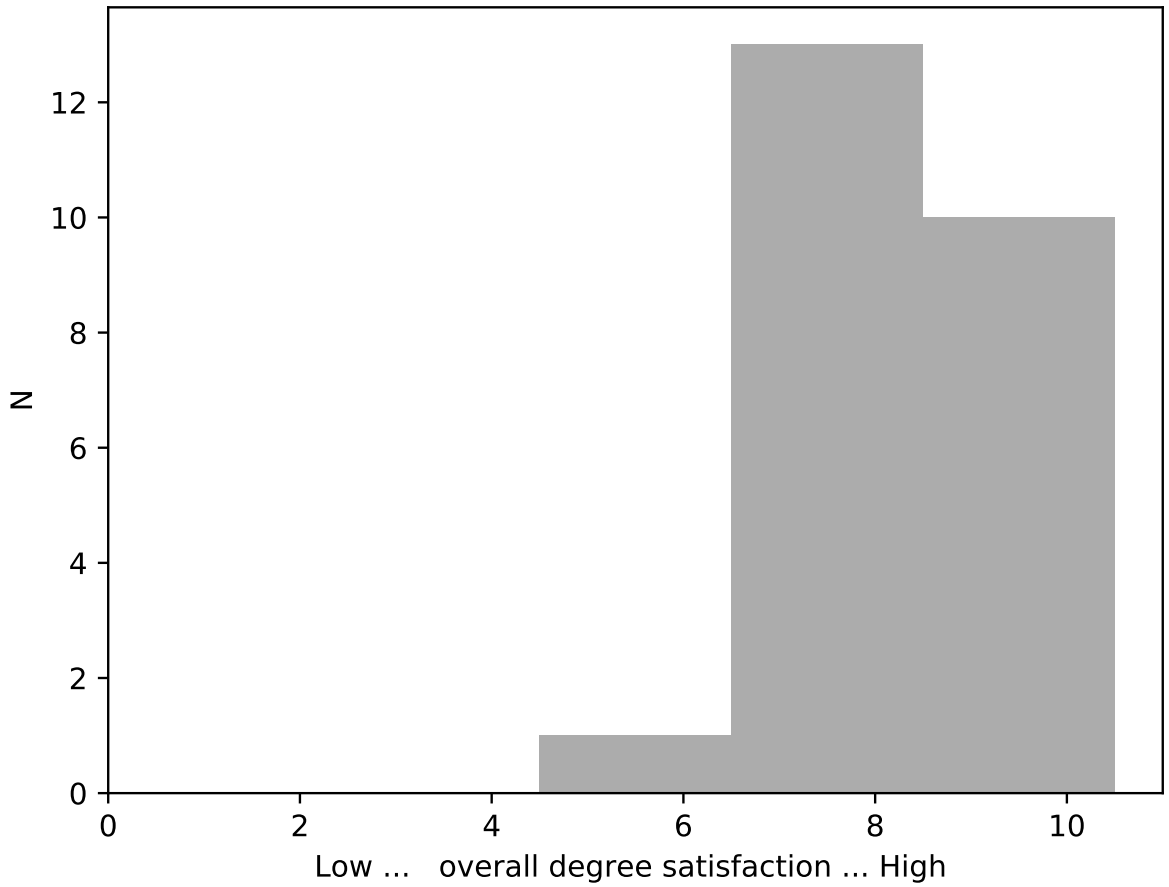

Figure 3: Overall satisfaction with undergraduate degree.

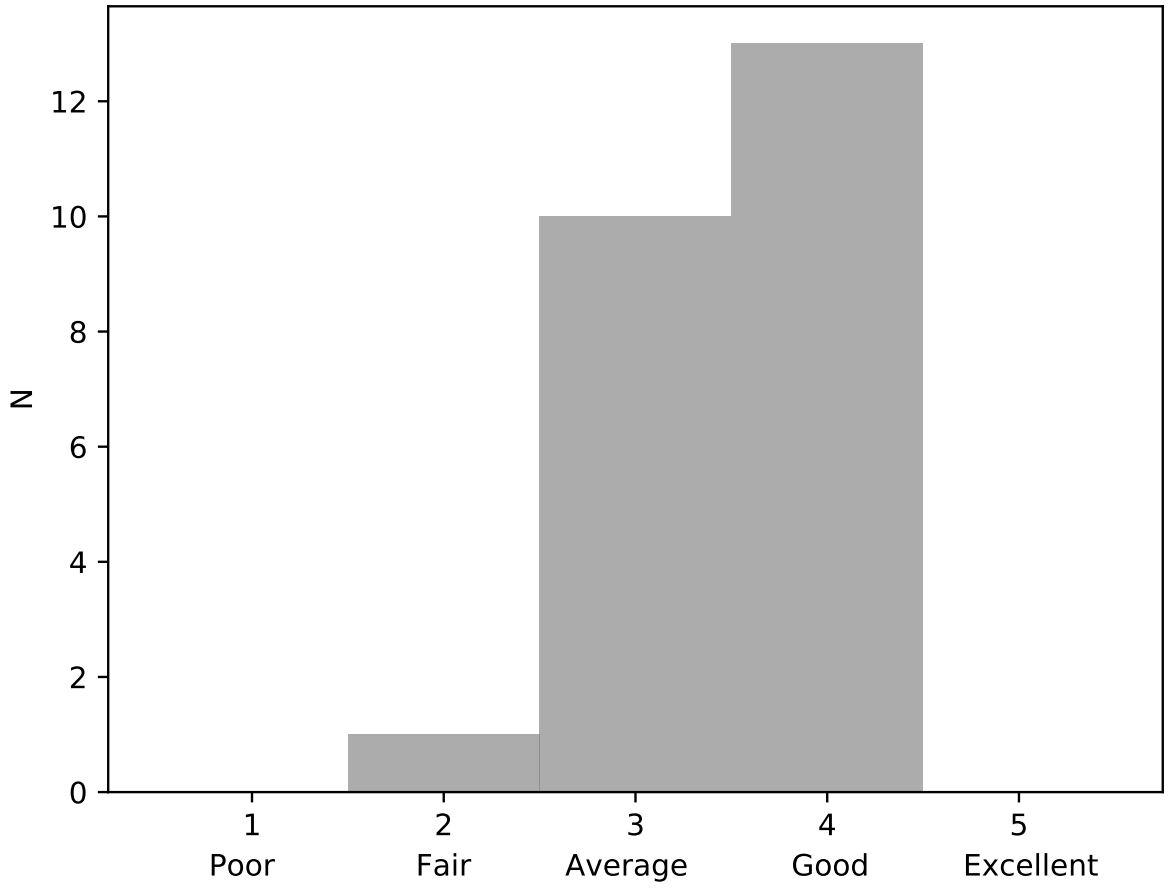

Figure 4: Perceived level of preparation relative to peers in first job out of UW, bachelor's only.

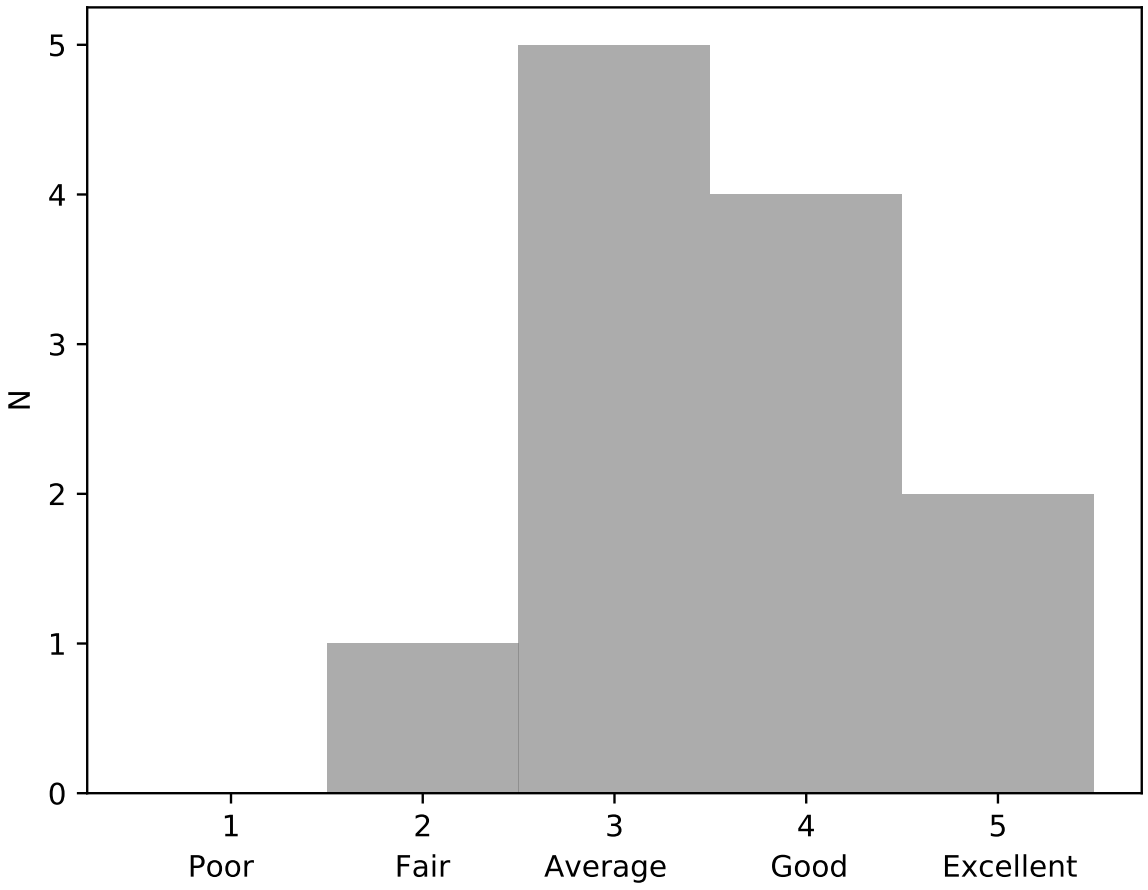

Figure 5: Perceived level of preparation relative to peers in first job out of UW, master's and PhD.

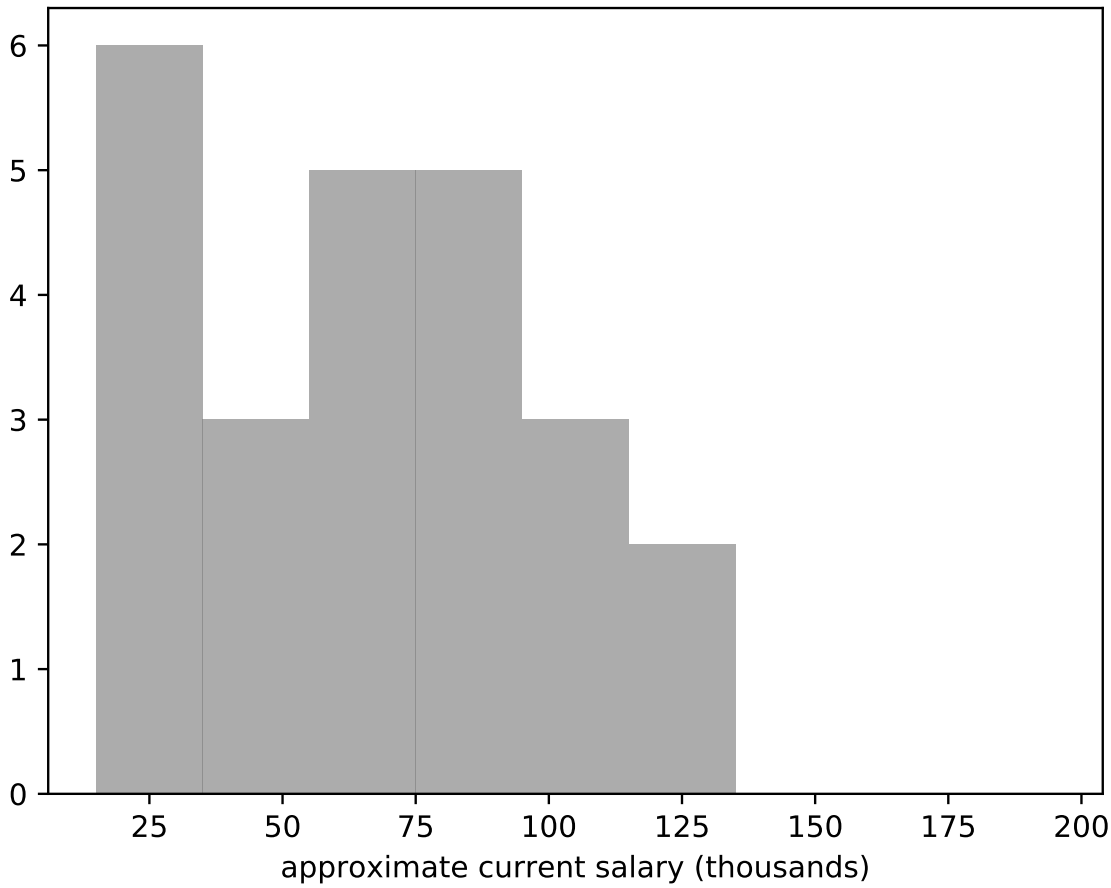

Figure 6: Annual salary in current position for 2010-2019 graduates. Note that many bachelors graduates are still in Masters or PhD programs where the annual graduate assistant stipends are in the $20,000–$30,000 range.

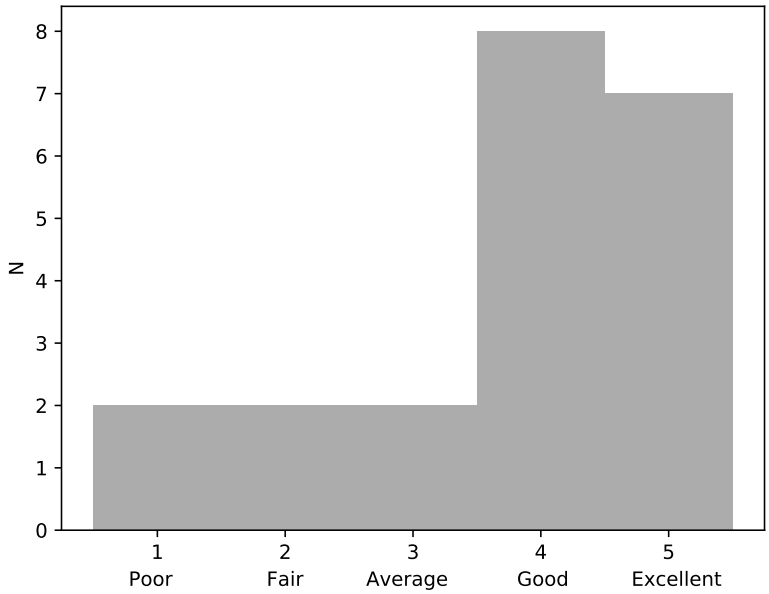

Figure 7: Knowledge of fundamental physical principles.

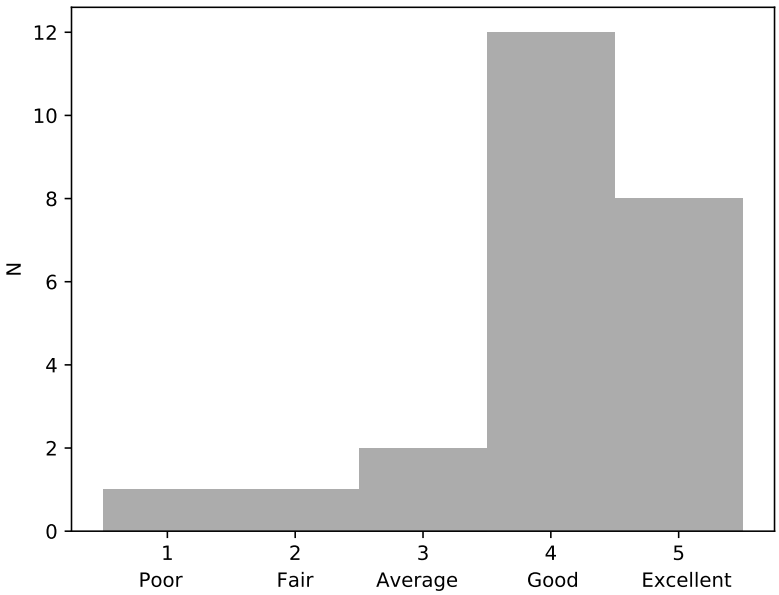

Figure 8: Ability to use mathematical methods to construct physical models.

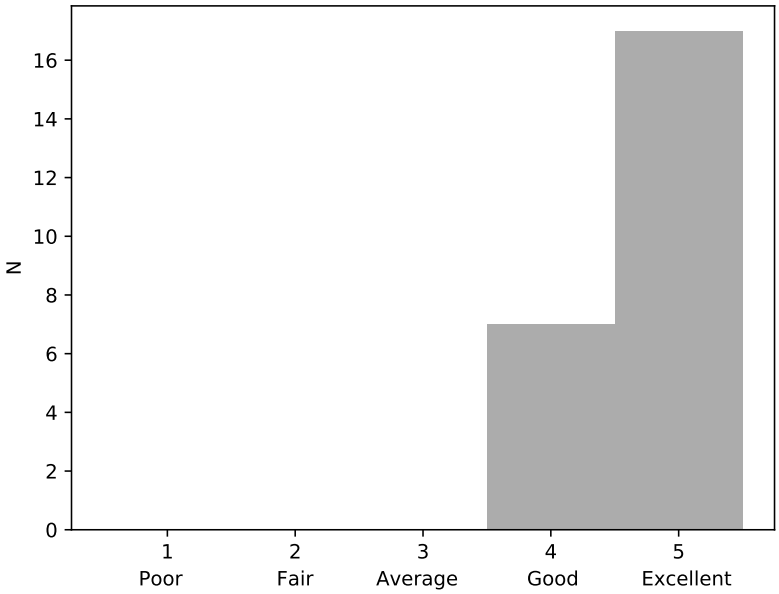

Figure 9: Ability to think critically about a problem.

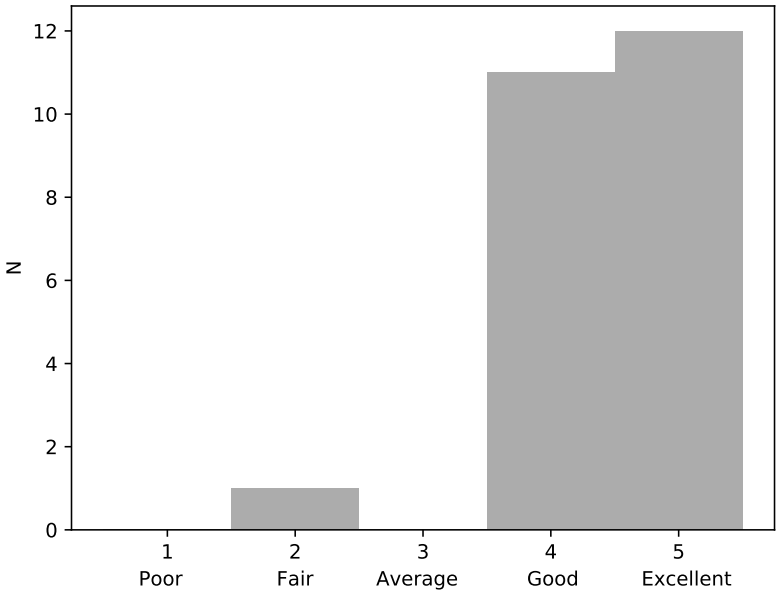

Figure 10: Ability to work as part of a science/engineering/technical team.

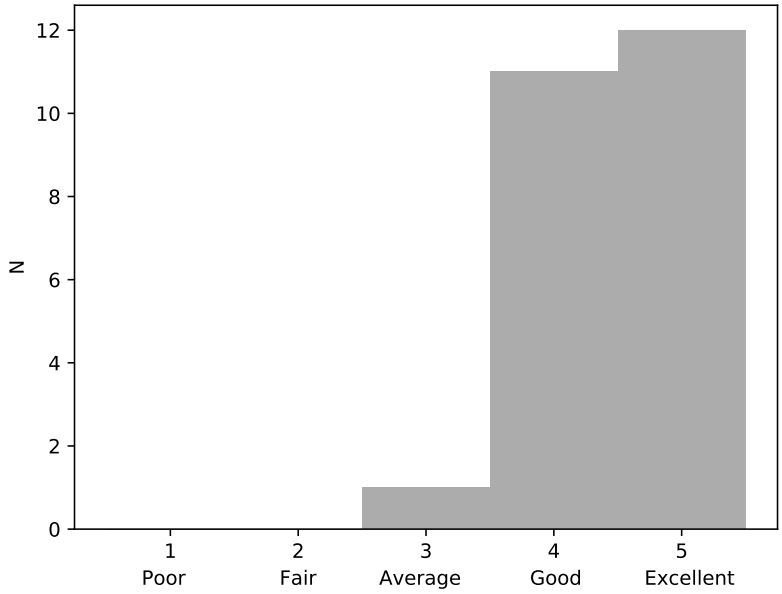

Figure 11: Ability to be resourceful and come up with creative solutions to problem.

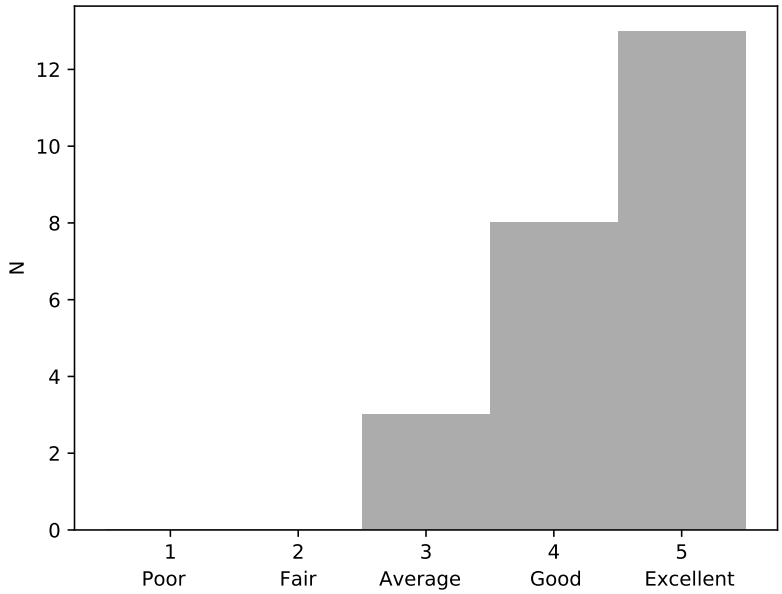

Figure 12: Comfort working in teams consisting of persons from diverse backgrounds/cultures/viewpoints.

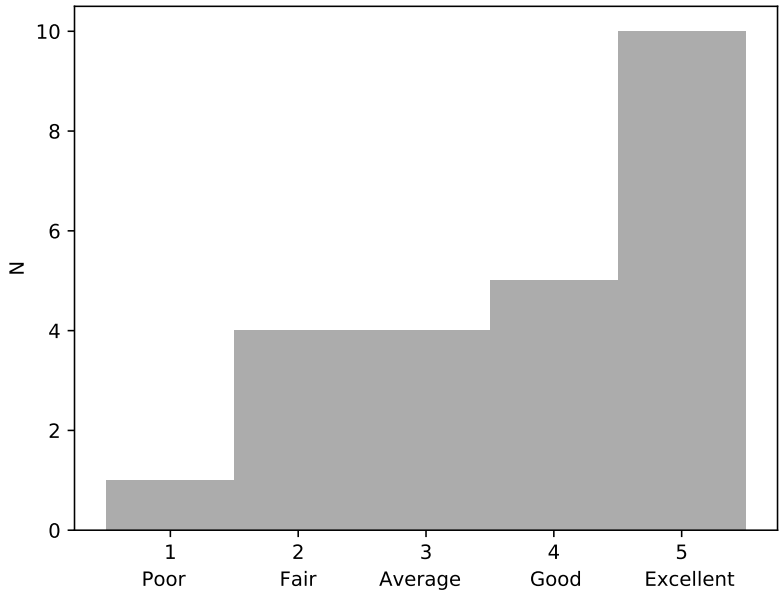

Figure 13: Ability to write technical documents.

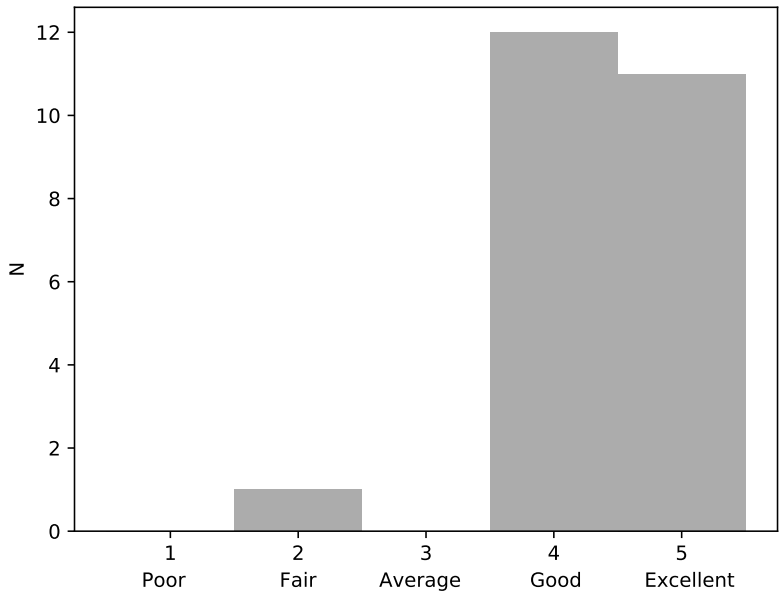

Figure 14: Expression in oral communication.

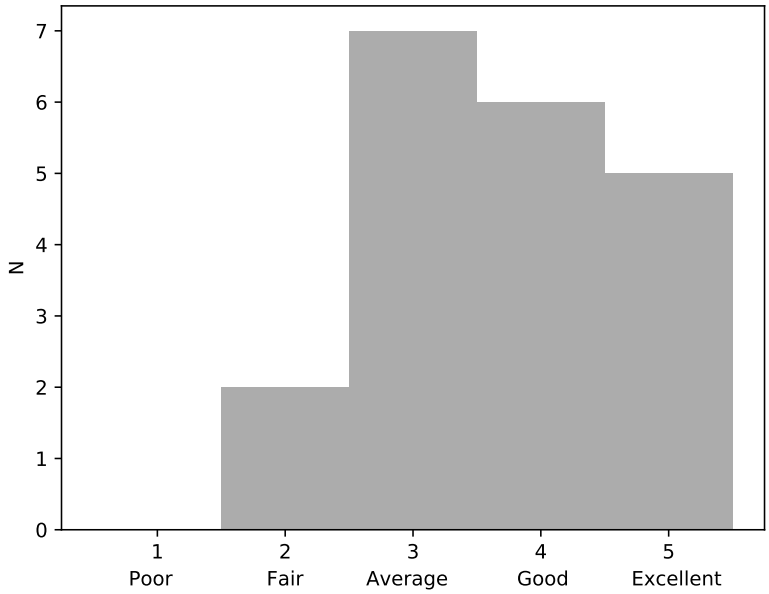

Figure 15: Fluency in laboratory techniques and equipment.

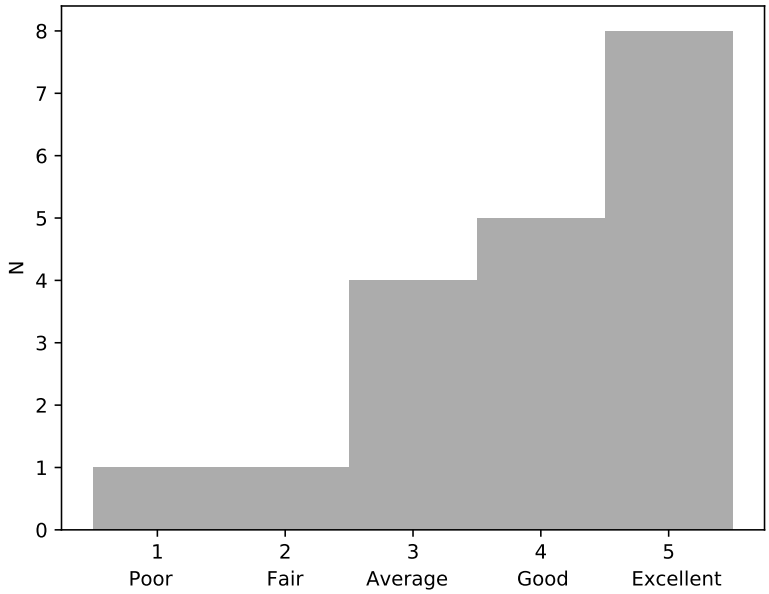

Figure 16: Preparation to teach physics/astronomy.

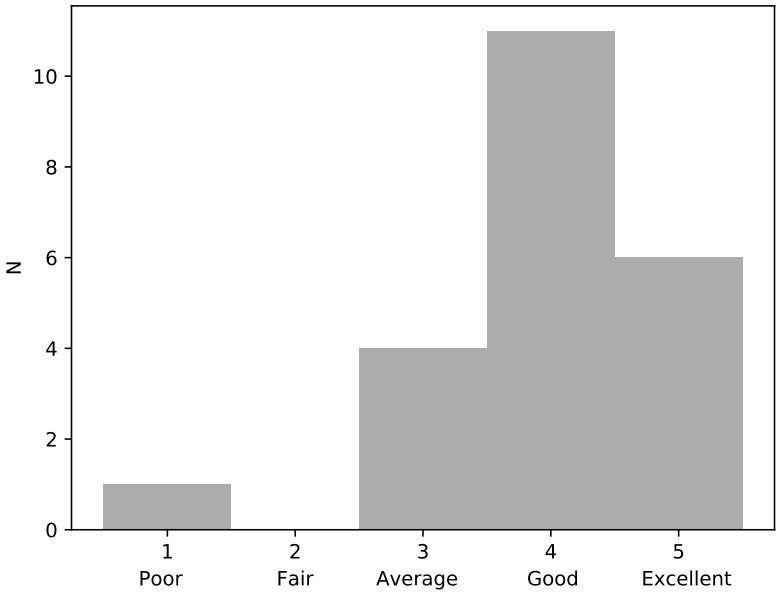

Figure 17: Preparation to do public outreach and education.

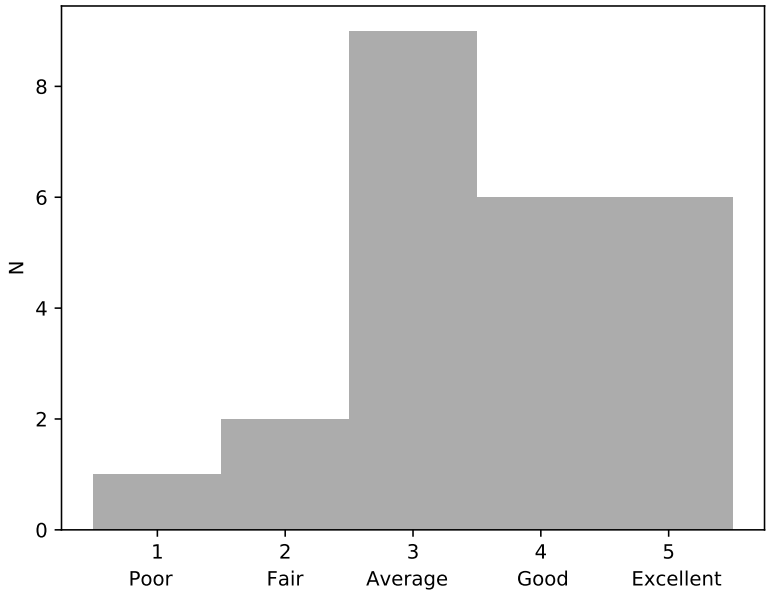

Figure 18: Ability to use a programming language (e.g., Python, Matlab, C++, java).

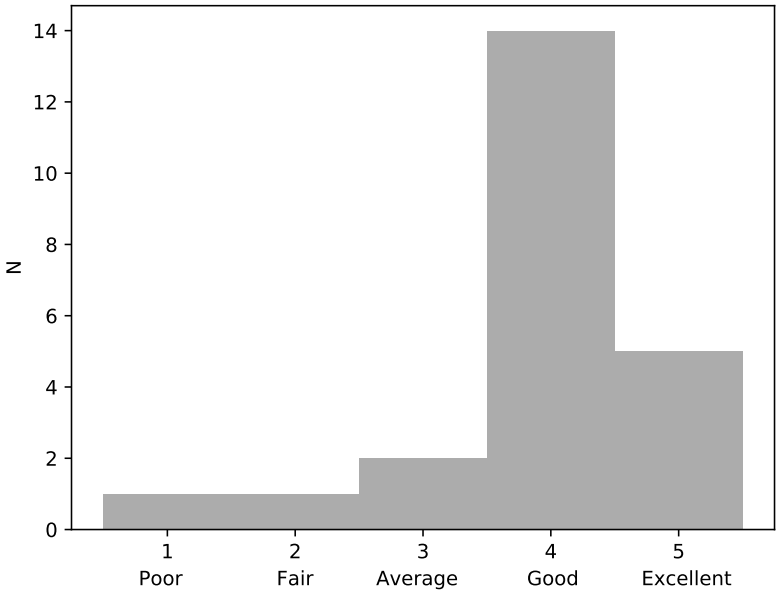

Figure 19: Ability to use software tools specific to your job (e.g., SolidWorks, AutoCad, Excel, webpage design).

3 Specific respondant comments, including those from graduate students.

Looking back on your time in the Physics & Astronomy Department, what advice would you give to current students who are working towards the degree that you received?

> Take advantage of the Wyoming resources! No other undergraduate program I've heard about compares to UW in terms of access to research, especially early in college. If students are interested in graduate school, research experience is critical to be competitive at top programs. Even a small research project at Wyoming will open doors to other opportunities, such as REUs and internships. However, academics are still important–make sure to learn the math and physics! Also, in modern astronomy, almost all work requires substantial programming, so having a good foundation in a language (I suggest Python) is very useful.

> I would recommend buying and reading advanced math (topology for instance) and physics (like quantum field theory), that are not taught at UW but extremely important in high energy physics (if that's what they want to later get into).

> Talk to your professors and dig into the resources they have to offer. Undergraduate research is so accessible at UW because the student to faculty ratio is incredible. There are so many opportunities to grow and contribute to the Physics & Astronomy community at the University of Wyoming, take advantage of them!

> Try to get involved with undergrad research if you have the time

> Do at least one summer internship OUTSIDE of academia. Many PhDs do not end up teaching, and it's good to know what government and private industry jobs are like before you finish school.

> The most valuable thing I took from my courses, and a big reason for my success in them, was sharing knowledge with my classmates. They can help you understand something you missed and helping them will deepen your own knowledge.

> Connect with school of engineering if interested in the private sector jobs

Study multidisciplinary. Physics is an excellent foundation for just about any job out there, but in today's startup world, it is key to know other fields, mechanical engineering, electrical, programming (scripting), statistics/data science.

Do not anticipate that your career will be in academia. Think broadly and keep an open mind. The world needs highly technical people that can solve hard problems that require critical thinking, experimental design, and rigorous scientific analysis and are willing to pay and good salary.

An undergrad in physics wont get you a lot of jobs but it will teach you about critical problem solving skills and will teach you about how much of the world actually works. It's a difficult degree but if you can persist you will be able to do about anything in life. My masters and doctorates, while not in physics, where so much easier because of my reference frame. You won't learn everything you need in this program. Some of the professors can be difficult. But its what you make of your time that lasts beyond your bachelors.

Dont give up because it seems difficult, its supposed to be difficult

1. Don't be afraid to ask the stupid questions . Chances are that if you aren't understanding, others aren't either. 2. Find a cohort and work with them on your homework sets. This will let you see what you know and what you still need to get clarification on all while hanging out with friends and being productive. 3.Try thinking about why a professor has asked you to complete an assignment or task. Consider why it might matter in the grand scheme of things. 4. Get to know a couple of instructors really well. If you're doing these other things, you probably won't have an issue with this.5. Try to get research experience if you can. I know that college is time consuming and you often need to work outside of class, but even doing research over the summer can help set you apart from your peers and aid you in understanding all of the material, and the big picture ideas better.

Learn a directly employable skill. For me, this skill was programming. Academia often has an over abundance applicants, so it is always good to have a backup plan if this is the direction you choose (plus you may change your mind as you work through a program). While employers value education, they are pragmatic and will choose someone with applicable experience whenever possible.

I see that Advanced Quantum Mechanics is available – take it.If you are interested in pursuing an astronomy graduate degree, take advantage of UW's undergraduate research opportunities. Participate in grad-student-level research discussion like journal club.

Start looking at different career directions early and identify what education/skills they require. Even if you are planning on staying in academia, prepare for the backup case and make sure you can have a good industry resume as well as a good academic CV. Aloso, there is a great diversity in jobs beyond traditional data science that can be found by a job search for physics

Want to be a teacher? Focus on the fundamental concepts and practice teaching them to your peers (both in and out of the physics/astro dept). Make sure you thoroughly understand EVERY topic (they're all related!). If you decide you can't hack it as a professional scientist, that alone is not a reason to go into teaching - the world needs more physics teachers, but not more physics teachers who can't teach effectively because they lack content/pedagogical skill/knowledge (you will only discourage students from participating in science if you do! I see this every day in my school!). Only go into teaching if you discover you really enjoy and/or have a knack for it. Want to be a professional scientist? Talk to professors about joining their research teams as early as freshman year! Also also, if you aren't a particularly high-flyer (for academics and/or intelligence), you may need to find a different field to pursue or be willing to strongly bend your expectations of what the work will be like. You may need to bend expectations even if you ARE a physics/astronomy wunderkind, but it's hard for me to say having only been in the former group.

Invest time in preparing for interviews in industry

Pursue outside internships as much as you can! Do not focus simply on academic internships or REU programs, but look seriously at internships with private sector operations. Not having engineering on your degree might be an obstacle to your (early) career, so work as hard as you can while still in school to build experience that obviates that.

Passing your courses is important, but you won't really learn anything in them, so do self study on the side in Quantum Mechanics, Electricity and Magnetism, and Statistical Mechanics. Also make sure to get into one of the more active research labs in your first or second year, and do significant research work throughout your time at UW.

You are not alone. College is an ideal time to learn how to work with a group to tackle problems together (something you'll be doing the rest of your career). Find groups in your departement/year/classes and work together, communicate, and relax together. Make friends and connections who you can talk to and work through hardships with. You are not competing with

each other, so help each other. Trust me, working with groups makes all the difference in the world.

If you want to get a job as an astronomer, take preparation for grad school very seriously. I'm in an engineering position (which I love) but for those that have no interest in engineering and are set on the science side, it's very difficult to find astronomy jobs that aren't looking for anything less than a post-doc.

My advice to students working towards a Physics and/or Astronomy degree would be to network as soon as possible and get involved with ongoing research. These two things are readily available to you as a student and will help prepare you for the next steps in your professional career. Lastly, I would also recommend students take advantage of office hours! Your professors want to help you. By stopping in their office you are not only bettering your understanding of the material, but you are also helping your professor understand what they could do to help the class as a whole.

I am a bit biased. I absolutely loved my time in UWyo. Loved the people I worked with and was very happy to go to school every day. The best advice that I keep giving to starting grads is to be **very very honest** with their advisor. Don't try to show off in your advisor's office. If you don't know even the most basics of your research, don't be afraid/shy/intimidated/insecure to ask. Meet with your advisor every single week that they are around. Even if you have had no progress that week. This motivates you to have something to show next week and keeps you on track. Gauge your expectation about your post graduation prospect based on your efforts and achievements in grad school and eventually your adjusted goals. Visit as many schools as you can and present your research. See where other grad students are in their Xth year and learn from their paths wherever it applies to you. But at the same time, keep a balance between life and work and enjoy yourself. Grad school is a significant chunk of your life and it better not be remembered as a torturous time you endured but a joyful endeavor that makes you smile.

To current students at the UW Physics & Astronomy I would advise not to see their TA responsibilities as a burden or simply as a job for the Department. See it as training and education for their possible future position as a college or university professor. By TAing you will gain many skills in how to talk and approach students, and how to go around our own understanding of physics and astronomy in order to explain it properly to another person.