Transforming U.S. Particle Physics Education

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Full Results: arXiv:2204.08983

ABOUT THE SURVEY

- Ran a survey targeting particle physicists to learn:
  - Skills used during careers
  - How these skills were acquired
  - Preparation for careers
  - Undergraduate engagement in the particle physics community
- Demographics:
  - 357 responses: 24 undergrad, 333 grad+
  - Respondents almost entirely from colleges/universities + national labs; limited participation from industry professionals
  - Did not identify protected identity groups (sample size small)

SAMPLE QUESTIONS

- How satisfied do you feel with your (under)graduate education in physics? In particle physics?
- What was the primary mode of training you received for various skills, and how do you rate it? E.g. university course, online, summer school, peer learning, self-taught.
- Some skills surveyed: statistics, programming, engineering, BSM theories, gravity, CV-writing, mentorship, teaching, writing
- How well do you feel graduate school prepared for career paths: academia, national/private lab, industry, teaching K-12?

Undergrads only: When did you first have an opportunity to perform research? What type of opportunity was it?

WHY SHOULD YOU CARE?

- Only about half of physics PhDs go into academia
- Need to train students for a broad variety of careers and teach multi-disciplinary skills beyond physics fundamentals and field-specific research tools

FINDINGS

- 1. Survey respondents are mostly satisfied with their graduate education, but feel unprepared for careers outside academia + labs.
- 2. Many respondents switched their career goals away from academia during graduate school. Many switched their research goals from HEP theory to HEP experiment.
- 3. Professional skills are more correlated with reported career preparation than technical skills.
- 4. Professional skills are frequently gained through self-teaching rather than through training. Self-teaching is disfavored by respondents for all types of skills; formal modes like university courses are highly-rated for all skills.
- 5. Very few survey respondents were undergraduates. We hypothesize this is due to low engagement of undergraduates in the community; they may not be on Snowmass email lists, experimental collaboration email lists, etc.

RECOMMENDATIONS

- 1. Train Students for Industry
  - Departments should facilitate industry partnerships + internships
  - Formal development of skills in-demand beyond academia

- 2. Normalize Non-Academic Paths
  - Departments should provide a realistic view of common career paths post-PhD in particle physics, including breakdown of theory and experimental positions
  - Faculty should discuss the commonality of shifting to a non-academic career

- 3. Formalize Professional Skills
  - Support formal modes of training for skills that respondents don’t like teaching themselves: technical presentations, scientific writing, mentoring, job applications

- 4. Formalize Technical Skills
  - Formal course in statistics as part of undergraduate / graduate curriculum
  - Support training opportunities like summer schools & workshops

- 5. Connect with Undergrads
  - Funding agencies and professional societies should support networks like student conferences
  - Community should develop a mass communication network for undergraduate opportunities in HEP.

EARLY-CAREER DRIVEN EFFORT

- Vetri Velan
  - UC Berkeley
  - PhD Student
- Erin Hansen
  - UC Berkeley
  - Postdoc
- Olivia Bitter
  - University of Chicago
  - Master’s Student
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