What to do with the other 40%

building career preparation into the undergraduate physics experience

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Former Director – Society of Physics Students & Sigma Pi Sigma

The Physics Career Pathways Project
American Institute of Physics - Education Division
Project Personnel

Project Investigators
- Thomas Olsen, former Assistant Director – Society of Physics Students
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- Amanda Palchak, University of Southern Mississippi (2011)
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- Jose “Ro” Avila, King College, SPS Summer Intern (2013)

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Project No. 1011829, “Expanding the STEM Workforce by Equipping Physics Bachelors Degree Recipients and their Departments to Address the Full Range of Career Options”
Overview

- Motivating Data
- About the Project
- Research & Resources
  - adding to the SPIN-UP list for success
Why should you care?

Physics bachelor’s degree production is on the rise.

http://www.aip.org/statistics
Motivational Data

Where do physics students go after graduation?
Good question….

Let’s consider
20 Hard Working Physics Students
≈ 40% --Directly into workforce about the same number who pursue degrees in Physics/Astronomy!

*20* Hard Working Physics Students
One year later.

Physics BS/BA
One year later.

Good news!
One year later.

<table>
<thead>
<tr>
<th>Highest Degree Offered by Department</th>
<th>Graduate Study</th>
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<tbody>
<tr>
<td>PhD-granting (N=2,051)</td>
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<td>43</td>
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<td>20</td>
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<td>37</td>
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<tr>
<td>Master's-granting (N=277)</td>
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<td>22</td>
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<tr>
<td>Bachelor's-granting (N=1,974)</td>
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<td>26</td>
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<td>24</td>
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<td>50</td>
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</table>

Percent

- Physics & Astronomy
- Other Fields
- Employed or Seeking

http://www.aip.org/statistics
Employment.

Initial Employment Sectors of Physics Bachelor’s, Classes of 2009 & 2010 Combined

- Private Sector: 53%
- College & University: 13%
- High School: 11%
- Civilian Gov’t, National Lab: 10%
- Active Military: 8%
- Other: 5%

http://www.aip.org/statistics
Private Sector Employment Details

Field of Employment for Physics Bachelor’s in the Private Sector, Classes of 2009 & 2010 Combined

- Engineering: 32%
- Non-STEM: 26%
- Computer or Information Systems: 21%
- Other STEM: 8%
- Other Natural Sciences: 8%
- Physics or Astronomy: 5%

STEM refers to natural Science, Technology, Engineering, and Mathematics.

http://www.aip.org/statistics
Data is clear, in spite of...

- A cultural **default focus** in many departments
  - preparing students for entry into advanced physics degree programs.

- Physics is perceived by many as an academic major with no direct pathways to careers outside of academia
  - despite evidence that clearly indicates the Physics BS/BA is a marketable degree
Important facts.

FACT: At graduation, physics bachelors students have OPTIONS.

FACT: Many physics students don't know this.

FACT: Many physics faculty members don't know this.

FACT: Many career services personnel don't know this.
What could happen if....

We could learn how
to do a better job of informing current (or potential) students about the broad range of career opportunities

and

to better prepare students for the broad range of career opportunities....
Choosing the path.

Students should be equipped for the path they choose when they complete their bachelor’s degree.

Departments that provide programs that address a broad range of career trajectories for their undergraduate students tend to be most successful.
Goals: AIP Career Pathways Project

- Inform and equip departments that wish to better prepare students to enter the workforce.

- Equip students with tools specific for physics aimed at career development.
Investigation.

(Following the SPIN-UP model)

Identify schools that

• had a strong record of granting physics bachelor’s degrees compared to other physics departments within their type;

and

• were among the national leaders in terms of the percent of their recent physics bachelor’s recipients who entered the STEM workforce within one year of earning their degrees.
Identified Common Features

Curricular
* Varied and high quality lab courses
* Research opportunities for undergraduates
* Curricular flexibility
* Communication skills as part of the physics curriculum

Extra-curricular
* Faculty and staff commitment to student success
* Strong community of students
* Connections with alumni
* Relationship with the Career Services Office
* Mentoring/advising in accordance with interests and goals
**Common Features**

**Curricular**
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**Extra-curricular**
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Interesting (and important)

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Extra-curricular
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How’s your department doing?

**Curricular**
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Building in Career Development

- Step 1: Inform Department Leadership
- Step 2: Inform Faculty (and Students)
- Step 3: Challenge faculty (*and students*) to think differently....and to make changes!
- Step 4: Use resources!
New, very useful…
Resources for undergraduate Career Development

American Institute of Physics Career Pathways Project
AIP Statistical Research Center
Society of Physics Students
www.spsnational.org/cup/careerpathways/

NSF Award Number: 1011829

Tools for Career Services Professionals

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3/8/2015
The Careers Fact Sheet.

Designed using common features, AIP data and guidance from career services professionals encountered during site visits.
Equipping Physics Majors

A comprehensive report for faculty with guidance for effective practice—based on identified common features.
Example: Curricular feature

Varied and high-quality lab courses

- **What faculty members can do:**
- Consider improving lab opportunities by offering additional or more varied labs, while also considering how to offset the increased faculty workload.
- Aim to provide a range of lab experiences ...with specialized software packages (e.g., LabVIEW)
Example: *Faculty and staff commitment to physics majors’ success at all levels*

**What faculty members can do:**

- Incorporate talks by physicists working outside of physics academia into your colloquium schedule, perhaps drawing on alumni or local industries.
- Talk about the variety of career options open to physics students in introductory physics classes and beyond. Consider including an introduction to physics careers in a freshman seminar or in SPS chapter meetings, perhaps using the Careers Toolbox.
The Careers Toolbox for undergraduate physics students

Developed using common features, statistical research data, and the tremendous work of SPS Summer Interns over three summers.
Student Resource: The “Toolbox”

Eight professional development tools with built in exercises, activities

<table>
<thead>
<tr>
<th>1. Common Job Titles</th>
<th>5. The Job Search</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Informational Interviews</td>
<td>6. Knowledge &amp; Skills-Based Resume</td>
</tr>
<tr>
<td>3. Networking</td>
<td>7. Effective Cover Letter</td>
</tr>
<tr>
<td>4. Knowledge and Skills Assessment</td>
<td>8. Interviewing With Confidence</td>
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Building in Career Development

- Step 1: Inform Department Leadership
- Step 2: Inform Faculty (and Students)
- Step 3: Challenge faculty (and students) to think differently
- Step 4: Use resources!
  - Facilitating use of the Careers Toolbox for Undergraduate Physics Students
1. Jobs.

What kind of jobs do physics bachelor’s degree holders... hold?
**List of Common Job Titles**

**Engineering**
- Systems Engineer
- Electrical Engineer
- Design Engineer
- Mechanical Engineer
- Project Engineer
- Optical Engineer
- Manufacturing Engineer
- Manufacturing Technician
- Laser Engineer
- Associate Engineer
- Technical Services Engineer

**Computer Hardware / Software**
- Software Engineer
- Programmer
- Web Developer
- IT Consultant
- Systems Analyst
- Technical Support Staff Analyst

**Application Engineer**
- Development Engineer
- Engineering Technician
- Field Engineer
- Process Engineer
- Process Technician
- Product Engineer
- Product Manager
- Research Engineer
- Test Engineer
- General Engineer

**Education**
- High School Physics Teacher
- High School Science Teacher
- Middle School Science Teacher

**Research and Technical**
- Research Assistant
- Research Associate
- Research Technician
- Lab Technician
- Lab Assistant
- Accelerator Operator
- Physical Sciences Technician
2. Collecting information.
How can I figure out which job might be best for me?
Informational Interview.

A new research project: what kind of job do I want?

- What is an “informational interview”?
- How do I do this?
- Who should I contact?
- What do I say?
3. A Professional Network.
How do I build mine?
Networking: Not just for business majors.

- Where/when/how to network
- How to build your list of professional contacts
- Putting together a PERSONALIZED Elevator Speech
4. The key to success.
Careful consideration of knowledge and skills.
The Missing Link

Assessing and Articulating ... the unique set of knowledge and skills gained in the undergraduate physics experience

- The single most important tool
- Translation of what students know into language that describes desirable and marketable SKILLS
5. Searching.

Finding your opportunity.
Effective Job Searching.

- Using powerful online resources
- Efficient use of time to match SKILLS with a THE JOB (that the student WANTS)
6. The Resume.

Putting you on paper.
The effective resume.

What is the goal of the resume?

* How to write a resume that achieves the goal of getting an interview
* What to include (and what not to include)
* Customize resume to job application!
7. Introducing...YOU.

Writing a cover letter that carries impact.
The cover letter.

• Putting it together
• A formal introduction of yourself...on paper
• Format, content, how to make sure you stand out as a candidate for the position you want and are qualified to have!
Making the most of interview opportunities.
Interviewing with confidence.

- Making the interview count!
- Face-to-face or on the phone

Another opportunity to demonstrate knowledge and skills
Concerns

• Most faculty know little about getting a job outside academe
  – How can we teach something we don’t know much about?

• No room in the curriculum

• Timing – when to start providing training on career pathways?
Facilitating Career Development

- First steps: Inform!
  - Focus on facts, research results
  - Introduce career options EARLY.

- Use the Toolbox as a guide for students
  - Find a spot to introduce toolbox
  - Use the SPS chapter meetings as a venue
  - Introduce components across the curriculum

- In facilitating sessions, encourage group work!
  - Encourage individual self-driven continuation of the work...
Adding career training to your physics program...

*Should you?*

*Would you?*

*Could you?*

Build in career development as part of you undergraduate program?

*Will it help my students become super stars?*

*And —will it grow my two “big R’s”?*
All resources available online for download

spsnational.org
On the website

Tool #2: Informational Interviews

Once you have a list of job titles that sound interesting, the next step is to gather information about what each job really entails. An excellent way to do this is through informational interviews, professional meetings with individuals who have jobs that interest you.

Tool #3: Networking

Having great credentials is important when you begin searching for a job, but networking—making professional contacts—can expand your access to opportunities and provide valuable advice and guidance all throughout your career journey.
Small pieces or all at once

Tool #2: Informational Interviews

Once you have a list of job titles that sound interesting, the next step is to gather information about what each job really entails. An excellent way to do this is through informational interviews, professional meetings with individuals who have jobs that interest you.

Roll up your Sleeves

- The basic concept
- Why do information interviews?
- Setting up information interviews
- Preparing for informational interviews
- Following up after the informational interview

Get to Work

- Download the Informational Interviews exercise (PDF File)
- Download the full tool (includes background information and exercise) (PDF File)
Resources

www.spsnational.org/cup/careerpathways/

Toni Sauncy - tsauncy@tlu.edu

Kendra Redmond - sps-programs@aip.org.
The following slides were not presented,

- But are included for the use of meeting attendees –
- These “what if’s” kind of slides illustrate how we implement the workshop **with students.**
SPS Careers Toolbox Workshops

- Focus on Tool#4
- Groups create “super student”

Group work highlights the knowledge and skills of a group of students, allowing for interchange and learning from each other – not pointing out deficiencies of a single student.
Tool#4 – Knowledge and skills assessment

SHAPING YOUR OWN KEY TO SUCCESS.
WHO ARE YOU?

- Self reflection
- Serious consideration of life experience
- Nothing off limits
- Should take time, serious thought, and be revisited OFTEN
Consider this exercise to be a comprehensive brainstorm of cumulative life experience! Put it ALL down on paper!
<table>
<thead>
<tr>
<th>My classes / training</th>
<th>My leadership experiences / group activities / professional associations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intro Physics (made B's)</td>
<td></td>
</tr>
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<tr>
<td>My jobs / research experiences / internships</td>
<td>My hobbies / others</td>
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</table>
Now, carefully examine the collection of experiences that describe YOU.

Carefully examine your experiences. Identify one of the commonly used skills that appears in your experiences. Write this skill at the top of the “Identifying My Skills” page:

- working with laboratory equipment
- conducting research
- communicating complex ideas
- proficiency with computer hardware and software
- analysis and quantitative thinking
- working with others
- problem solving
- critical thinking
## Physics – Common skills

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<tr>
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<td>Others??</td>
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# BRAINSTORMING (example)

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</tbody>
</table>
Get to the point.

**Narrow it down.** Draft a bullet point related to this skill like one you might use on a resume
⇒ Keep this short and to the point

**Refine the language.**
Refine your bullet point, focusing on what you know how to do and how well you know how to do it. You may want to do a few drafts and get feedback from others on which is most clear, concise, and meaningful.

**Tell it.**
Write down a few specific anecdotes that demonstrate your experiences related to this skill.
Skill category:

Brainstorming: My experiences related to this skill category

Tell it: Draft a bullet point related to this skill

Refine the language: Refine your bullet point, focusing on what you know how to do and how well you know how to do it

Show it: Write down a few anecdotes that demonstrate your experiences related to this skill
### Skills Assessment Sheet: Example

#### Skill category: Working with others

**Brainstorming: My experiences related to this skill category**
Camp counselor, tutor (in Spanish and in freshman physics, and for math at YMCA), learning assistant, working with lab group (research), sing in choir and helped organize a research conference for my peers.

**Tell it: Draft a bullet point related to this skill**
Good at working in teams and cooperating in group situations.

**Refine the language: Refine your bullet point, focusing on what you know how to do and how well you know how to do it**

**Show it: Write down a few anecdotes that demonstrate your experiences related to this skill**
Refine the language: Refine your bullet point, focusing on what you know how to do and how well you know how to do it

Good at working in teams and cooperating in group situations
Teamwork and group skills—really good at it.
Strong teamwork skills; demonstrated comfort in a variety of group dynamics.

Show it: Write down a few anecdotes that demonstrate your experiences related to this skill
Your set of strengths.

YOUR skills

- Aim for about 5-10 skill sheets
- Should be revised regularly as your experiences grow and change
- Practice on-going self assessment to continuously update skills/knowledge list

List your “Tell it” bullet points below

List your “Show it” stories below

Hard work DONE.
Tool#3 – Networking
How to build your professional network.
General Networking Tips

- Prepare an “elevator” speech
- Network everywhere
- Help others
- Attend physics meetings
- Get involved!
- Ask questions!
- Network online
- Project a positive attitude
The elevator speech

*Stick to the basics.*

- Informational facts about you
- Who am I?
  - Be sure to include your name and where you go to school!
- What are one or two relevant, interesting things that I have done recently?
- What do I want to do?