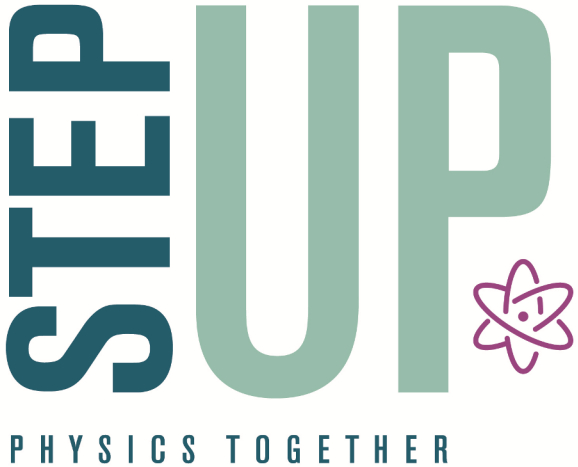
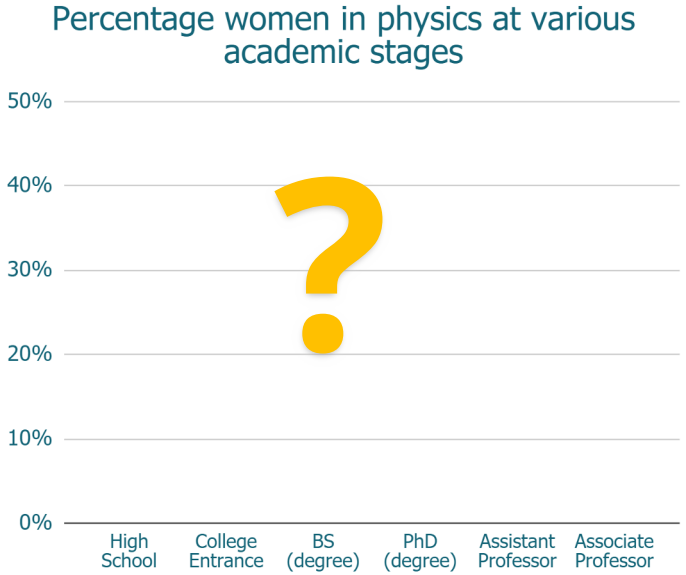


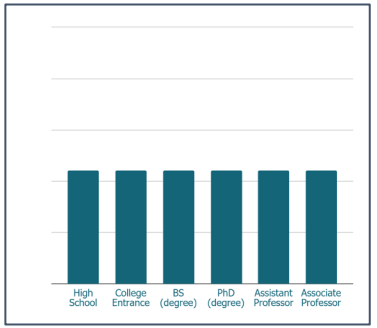
STEP UP workshop

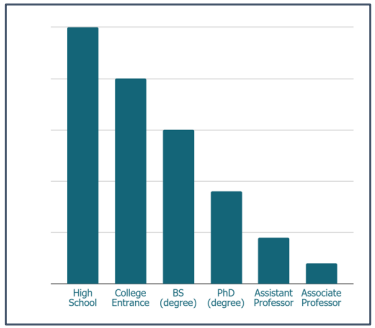
Alma Robinson

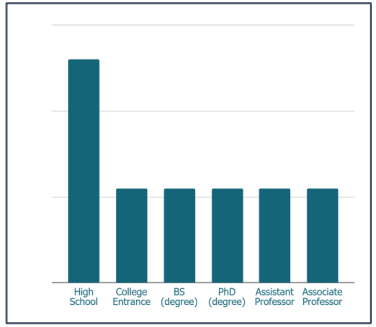
Gender Differences in Physics



Predict: What is the trend in women pursuing physics?
(Increasing? Holding Steady?)

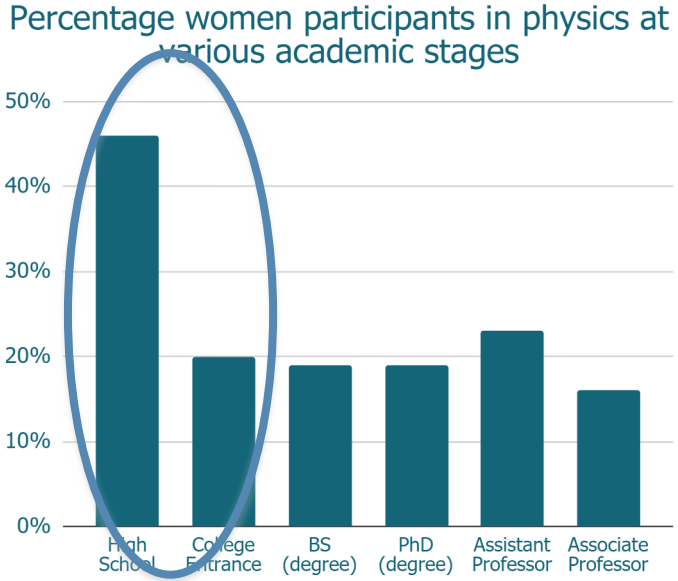


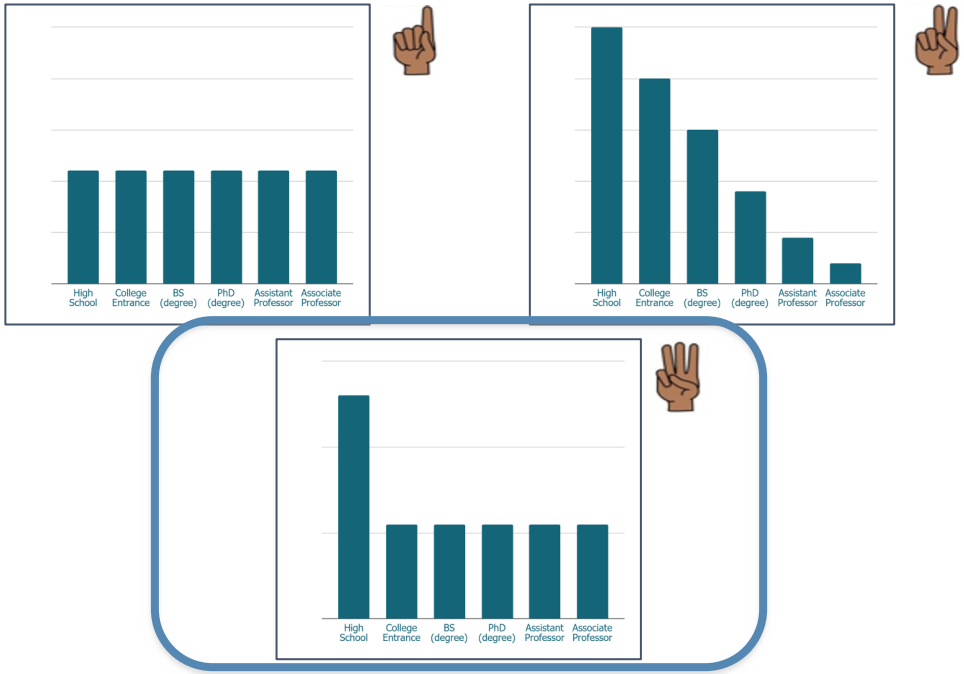




Pick your choice via a show of fingers.

Gender Differences in Physics



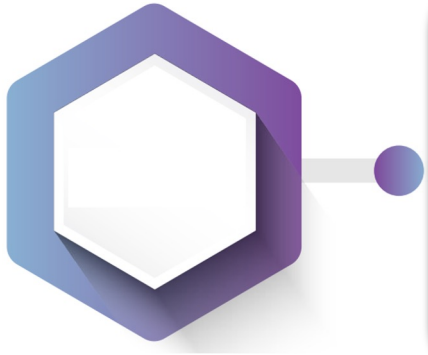


Note that college entrance refers to first-year students' intent to major in the field.

Source: Hodapp & Hazari, 2015

Project Goals

- Draw on research and evidence to mobilize thousands of HS physics teachers in the U.S.
- Reduce barriers and inspire young women to pursue physics degrees in college
- Shift deep-seated cultural views about who does physics



Although young women comprise 50% of high school physics classrooms, only 20% of physics undergraduate majors are women. Help us change things by inspiring high school teachers to energize young women to study physics.

Project Broad Goal

If half of US high school physics teachers encourage **just one more female student** to pursue physics as a major, a historic shift will be initiated - female students will make up 50% of incoming physics majors

You can be part of a historic change in physics!

Why intervene in high school?

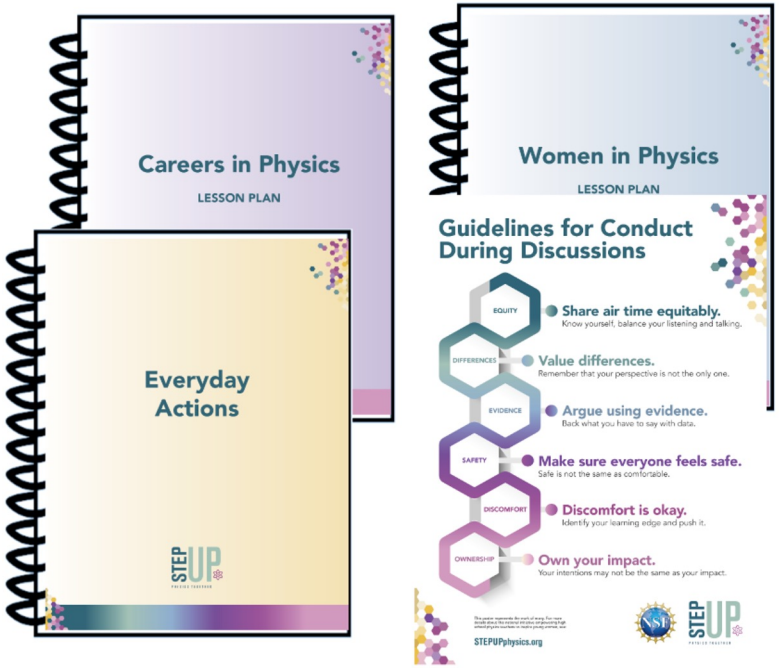
- Most women physicists become interested at this time
- Compared to elementary school
  - Teachers have greater content knowledge and are more vested in physics
  - Students are closer to decision-making time for majors
- Compared to college
  - Classes are smaller and there is more time to build relationships

Source: Hodapp & Hazari, 2015

What is STEP UP?

Guidelines and Lessons available for educators

- Careers in Physics Lesson
- Women in Physics Lesson
- Everyday Actions Guide



Sample Lesson: Careers in Physics

Please engage in “student mode” and imagine you are a high school student in physics class:

Name a career you can have with a physics bachelor’s degree.

Body of Lesson: Careers in Physics

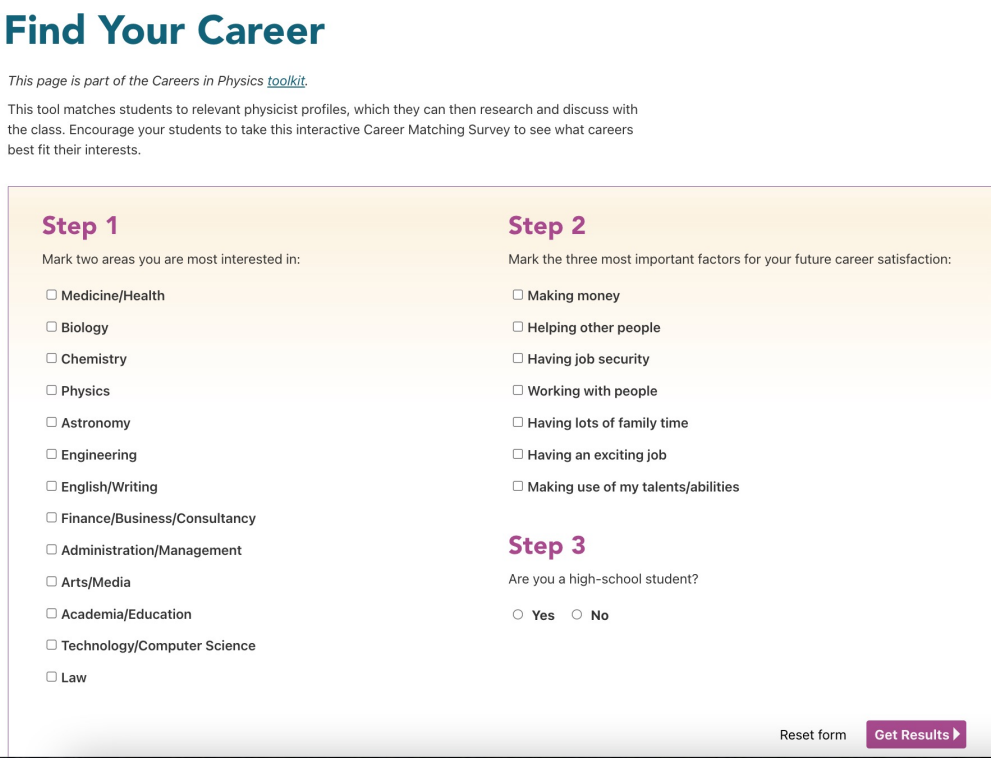
https://engage.aps.org/stepup/curriculum/careers/matching

Complete *Career Goals Pre-Survey*

- 2 questions

Mark two areas you are most interested in

Mark the three most important factors for satisfaction:



Find Your Career

This page is part of the Careers in Physics toolkit.

This tool matches students to relevant physicist profiles, which they can then research and discuss with the class. Encourage your students to take this interactive Career Matching Survey to see what careers best fit their interests.

Step 1

Mark two areas you are most interested in:

- ☐ Medicine/Health
- ☐ Biology
- ☐ Chemistry
- ☐ Physics
- ☐ Astronomy
- ☐ Engineering
- ☐ English/Writing
- ☐ Finance/Business/Consultancy
- ☐ Administration/Management
- ☐ Arts/Media
- ☐ Academia/Education
- ☐ Technology/Computer Science
- ☐ Law

Step 2

Mark the three most important factors for your future career satisfaction:

- ☐ Making money
- ☐ Helping other people
- ☐ Having job security
- ☐ Working with people
- ☐ Having lots of family time
- ☐ Having an exciting job
- ☐ Making use of my talents/abilities

Step 3

Are you a high-school student?

- ○ Yes ○ No

Reset form | Get Results

Body of Lesson: Careers in Physics

Example results

- What does your physicist **personally value** about their degree or career?
- Who **benefits** from their work?
- What did they **gain** from their physics degree?

Albin Gonzalez - Medical Physicist

One of the problems Albin Gonzalez solves nearly every day is how to position patients during radiation treatments for the most efficient and least painful access. He also routinely solves difficulties with the technology itself. Albin checks treatment plans and monitors the machines to make sure they're working properly and that their output is within an acceptable range. Together with doctors, dosimetrists, radiation therapists and nurses, Albin treats around 40 patients per day with extremely high doses of radiation. Physics allows Albin to work in a fast-paced environment that's constantly adapting to the latest technology. Right now, his department is lucky enough to use "a fantastic treatment planning system that is the latest in the market," he says. It makes treatment plans much more efficient, which is good news for cancer patients!

▶ https://aps.org/careers/physicists/profiles/agonzalez.cfm

Urszula Tajchman - Pediatric Cardiologist

In her job, Urszula Tajchman treats children with heart disease, as well as conducts research in molecular biology. Urszula received her medical training at the Johns Hopkins University. She then did her residency in pediatrics at the University of Colorado, and a fellowship in pediatric cardiology at the University of Iowa. She worked as a pediatric cardiologist at the University of South Dakota before becoming the first pediatric cardiologist in Central Oregon in 2002. Urszula is board certified in pediatrics and pediatric cardiology. She says that the best things about her job are caring for patients, teaching children and parents about their health, and studying therapies for disease.

▶ https://www.compadre.org/careers/physicists/Detail.cfm?id=2321

Jessica Barrios - Structural Engineer

Jessica Barrios was inspired to pursue engineering by her father, who is a professional petroleum engineer. "For as long as I can remember, I've enjoyed science, problem solving and building structures out of any material available," she says. Authentic and hardworking, Jessica enjoys tackling the different challenges unique to each project, "challenges that keep you on your toes no matter how much experience you have." She also likes seeing each project go "from drawings on paper to a tangible structure everyone can see, and seeing it safely used for its purpose." She was attracted to CE Solutions in 2016 because the growing company allows her to grow, too, within its distinctive culture. Jessica is a self-proclaimed "sports junkie," whether it's practicing, watching or simply talking about athletics. She also likes to watch movies, cook, and spend time with family.

▶ https://www.cesolutionsinc.com/jessica-barrios-1

Paul Davis - Applications Engineer

Paul Davis earned his BS in Physics at Howard University. He is employed through Corning, Inc and works on a team of engineers who support a major customer that uses Corning optical fiber to manufacture fiber optic cable. This industrial job allows him to contribute to the development of important products for the company and their clients. Paul's advice for students looking to follow on a similar path is to build a network with other students and professionals as "this can open doors." He also encourages asking lots of questions of this network and the world to stay curious and constantly learning. Paul also suggests that aspiring engineers join technical organizations and to make sure you "don't stay in a job that isn't meeting your needs."

▶ https://www.spsnational.org/career-resources/physicist-profiles/paul-davis

Lesson Closure: Careers in Physics

Predict: What majors do you think do the best on the MCAT (Medical College Admission Test)?

What about the LSAT (Law School Admission Test)?

Careers in Physics: Lesson Closure

Physics majors get high scores on assessments for both medical and law school

Scores on MCAT by major	
Degree Field	**Average**
Economics	10.5
Physics	**10.4**
Biomedical Engr	10.4
Mathematics	10.1
Electrical Engr	10.1
Neuroscience	10.1
English	10.0
Biochemistry	9.8
Chemistry	9.5
Microbiology	9.4
Psychology	9.3
Biology	9.1
Premedical	9.5
All Majors	**9.5**
Medical	

Scores on LSAT by major	
Degree Field	**Average**
Mathematics	162.2
Physics	**162.1**
Economics	159.1
Engineering	157.3
Chemistry	156.7
History	156.7
English	155.8
Biology	155.2
Political Science	154.3
Psychology	153.3
Computer Sci	152.3
Pre-Law	149.0
Criminal Justice	145.6
All Majors	**153.6**
Law	

STEPUPphysics.org

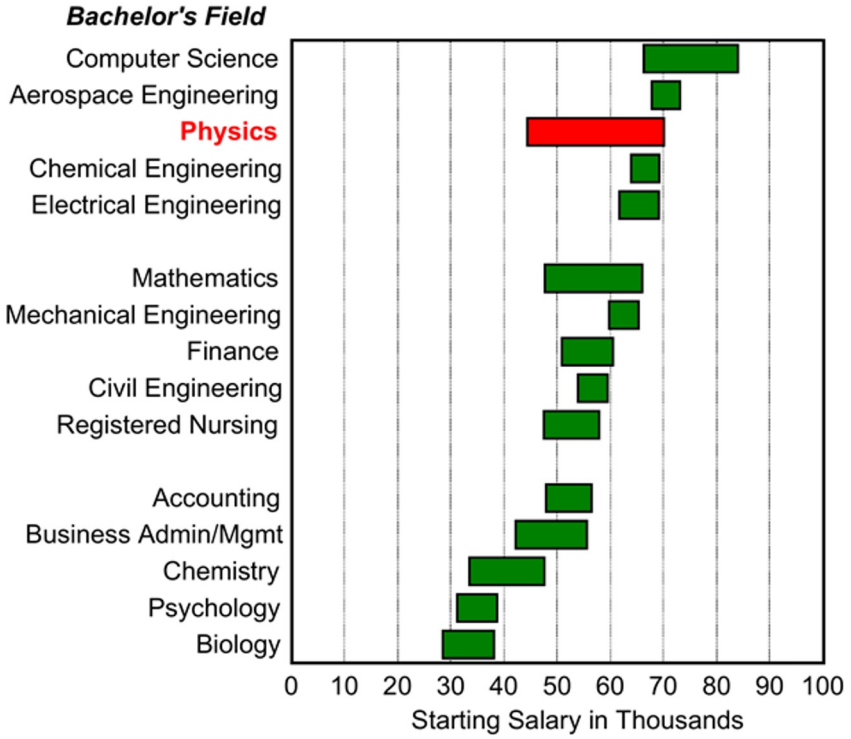
Source: Tesfaye & Mulvey, 2013

Careers in Physics: Lesson Closure

Predict: How do starting salaries for students with bachelor's degrees in physics compare to other fields?

Careers in Physics: Lesson Closure

Physics majors earn comparatively *higher salaries* than other fields



Source: AIP, 2016

Careers in Physics: Lesson Closure

Student Prompt-after discussion

What new careers emerged from researching the physicist's profiles?

Body of Lesson (OR at the end)

Personal Profile (for display)

Profile elements:

- **Name|Career Title|Picture**
- Who I am
- Why physics
- Using physics
- Advice for students

Master teachers have found the preparation of their personal career profile is a key and transformational part of this lesson for students.

Sample Career Profile

Carmen White
Mission Integration Manager

Who I Am
I am a space and music enthusiast who grew up in Roanoke, VA. I love stargazing and going to local and far concerts. I was the first person in my entire family to attend college. I enjoy working in a fast paced and eventful environment and love helping others.

Why Physics
As most kids did, I went through a phase of wanting to be an astronaut. However, I never really grew out of the phase. Since being an astronaut seemed a bit too extreme as I increased in age and realization, my love for space and science never diminished. My highschool physics classes strengthened my curiosity for wondering how things worked the way they do. I also attended VASTS at NASA Langley right after graduation which made me decide to major in physics with a minor in astronomy.

Using Physics
It is important for me to have an understanding of physics so that I can help other people when they have questions or concerns regarding a mission. Basic understandings and mathematical calculations are required, but the problem solving aspect that comes with physics is the most important part. Since I work with all systems and connect together all aspects for the mission, it is crucial to be able to have a sense of all components from each team. Having a minor in astronomy helps too due to the relation of spaceflight.

Advice for Students
Be curious. Explore those curiosities. Always do what you want to do; never let someone dictate your passions and interests. While you may encounter difficult problems/issues and want to give up, keep going. Do not be afraid to ask questions and to ask for help.

I give my permission for this profile to be posted in Robeson (if you do not want this to be posted, please delete this line)

Lesson Debrief: Careers in Physics

Teacher debrief thought and comments

- Is this usable?
- What would you use/not use?

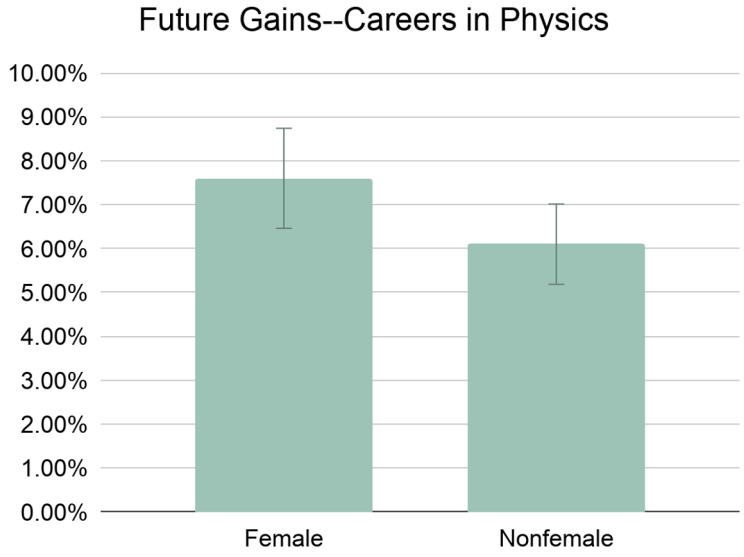
Lesson Evidence: Careers in Physics

What is the effect of this lesson on students?

Shown to improve students' future physics intentions

- majoring in physics in college
- intention to pursue physics-related careers

Overall gains from the lesson across all students are positive



N = 823

Source: Cheng et al., 2018

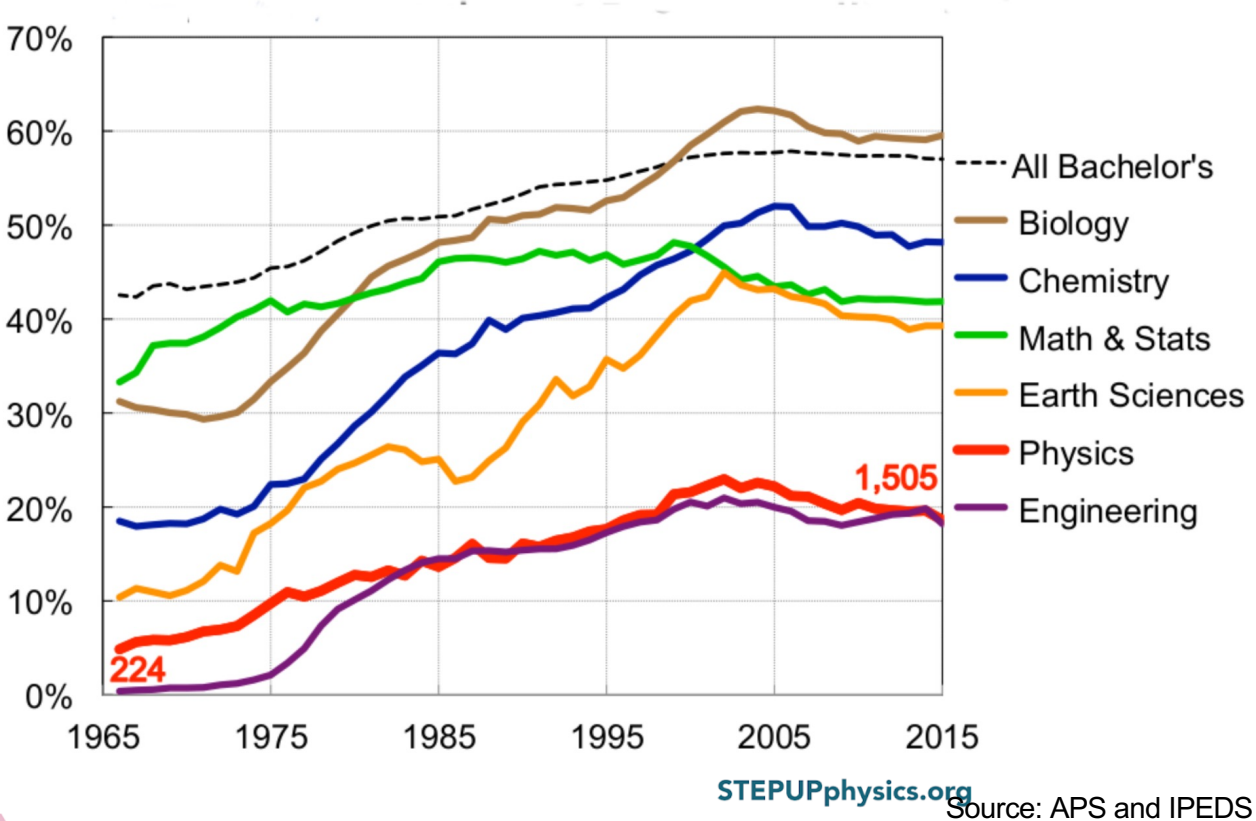
Women in Physics Lesson

Students examine the conditions for women in physics

We begin the lesson by Googling: famous physicist

What do you notice?

Percentage of Bachelor's Degrees Earned by Women, by Major

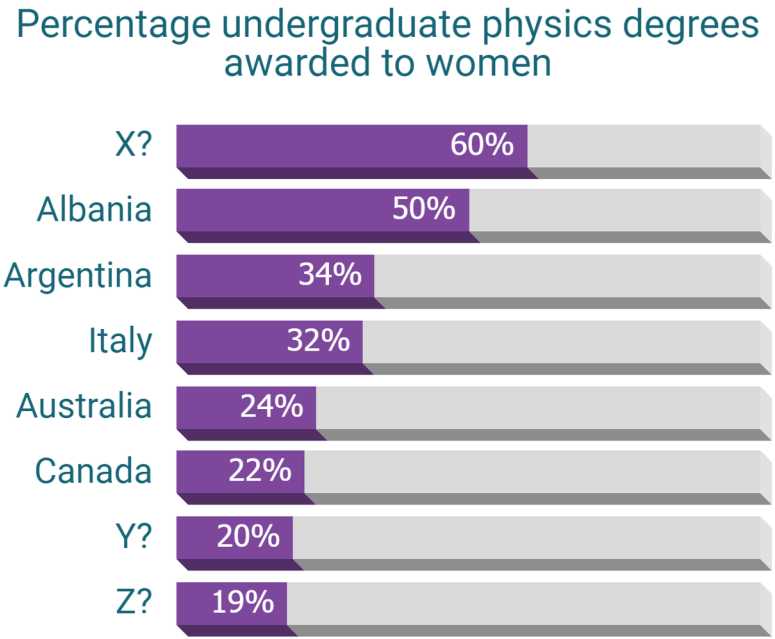


What trends do you see?

Why do you think women are better represented in some fields over others?

Source: APS and IPEDS Completion Survey

Comparing Across Countries

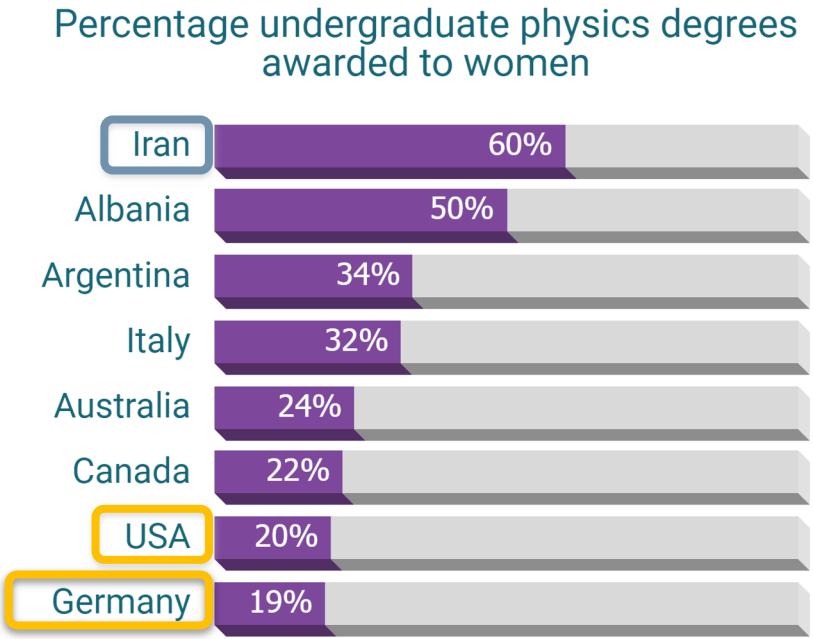


Predict:

- Which is country X?
  (highest percentage)
- Which is country Z?
  (lowest percentage)
- Country Y?

Options: Germany, Iran, USA

Comparing Across Countries



- **Check your predictions**

Source: IUPAP International Conference on Women in Physics Proceedings

Women in Physics Lesson

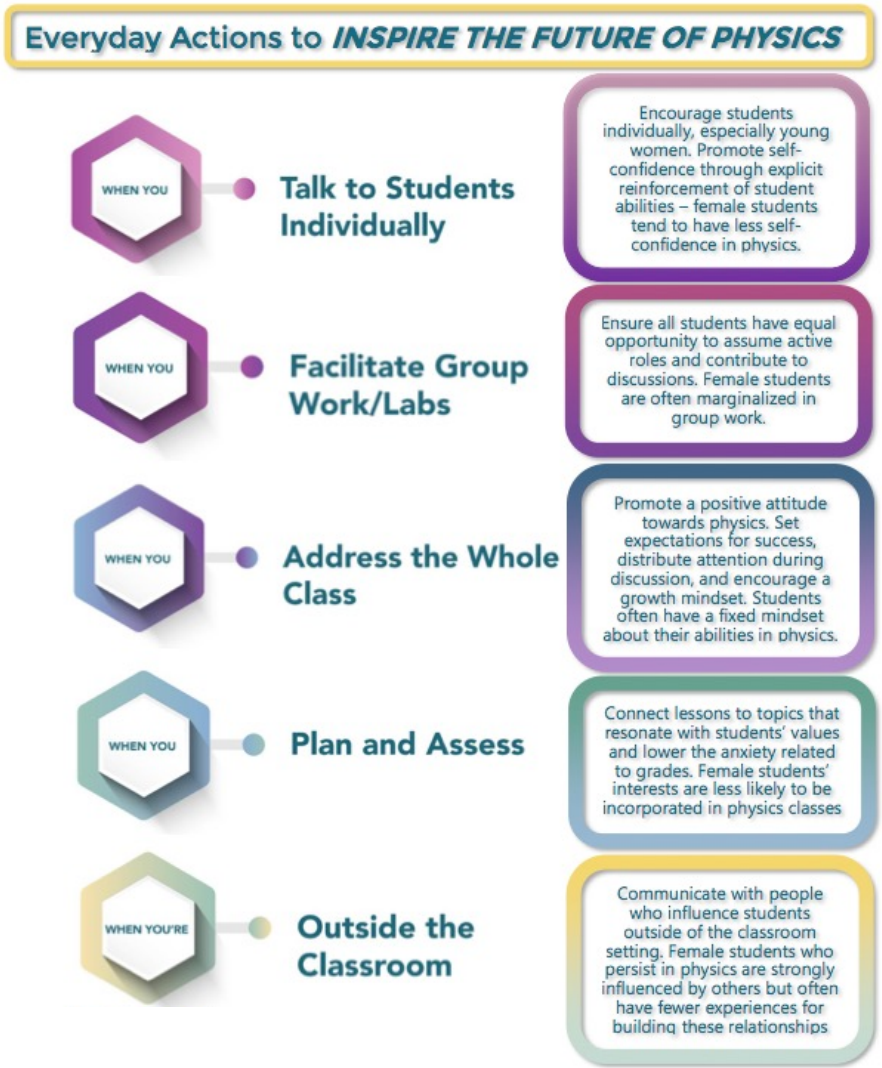
Students examine the conditions for women in physics

- Research famous physicists and analyze trends and stereotypes
- Discuss gender issues with respect to famous physicists
- See data about women in physics around the world and consider the role of culture and society
- Leverage personal experiences to neutralize the effect of stereotypes and bias
- My experience with the lesson has been very positive

Everyday Actions...to inspire future physicists

Classroom practices that promote the pursuit of physics

- Research-based and usable everyday in every classroom
- Compiled into *Everyday Actions Guide*
- How to...
  - talk to students individually
  - facilitate group work/labs
  - address the whole class
  - plan and assess
  - promote physics outside the classroom



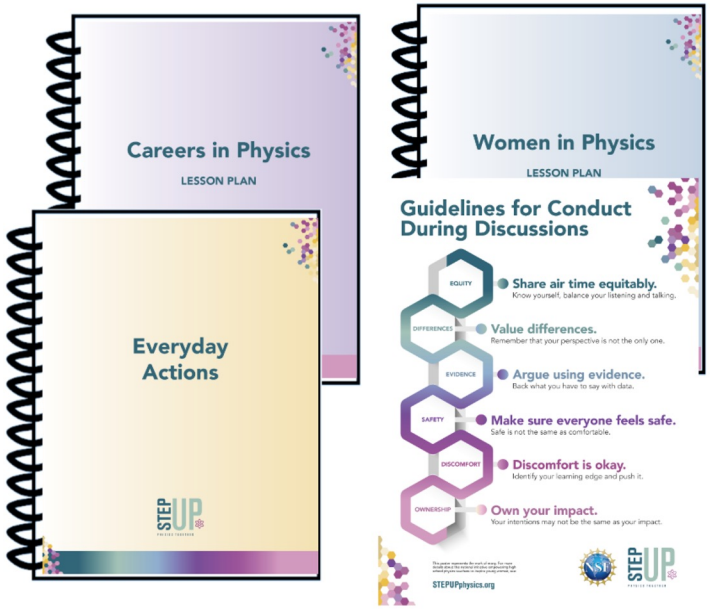
Which of these Everyday Actions are you already doing?

How do students respond to them?

Which will you start doing?

Resources available

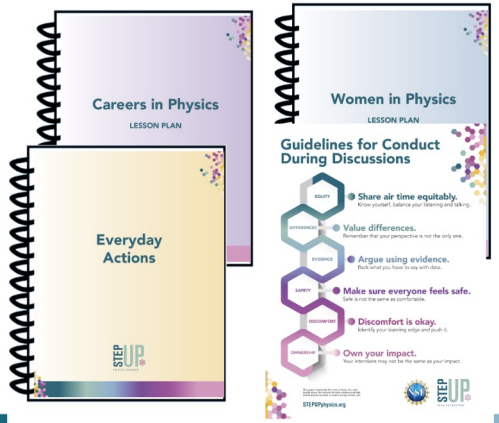
- Everyday actions guide
- Careers in Physics Lesson
- Women in Physics Lesson
- Classroom Guidelines Poster



How can you help?

1. **Register NOW at STEPUPphysics.org**
   Ambassador: Alma Robinson

2. **Learn about and implement effective strategies**



3. **Inspire women! Teach lessons on careers and women in physics.**
4. **Provide feedback. Tell us how it went!**

STEP UP

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