FIRE UP for STEP UP

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WAPT & SPS
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UWRF Graduate 2018
Major: Physics

UWRF STEM*teach* Cohort V (2019-2020)
Licensure: Physics

9th Grade Physics Teacher
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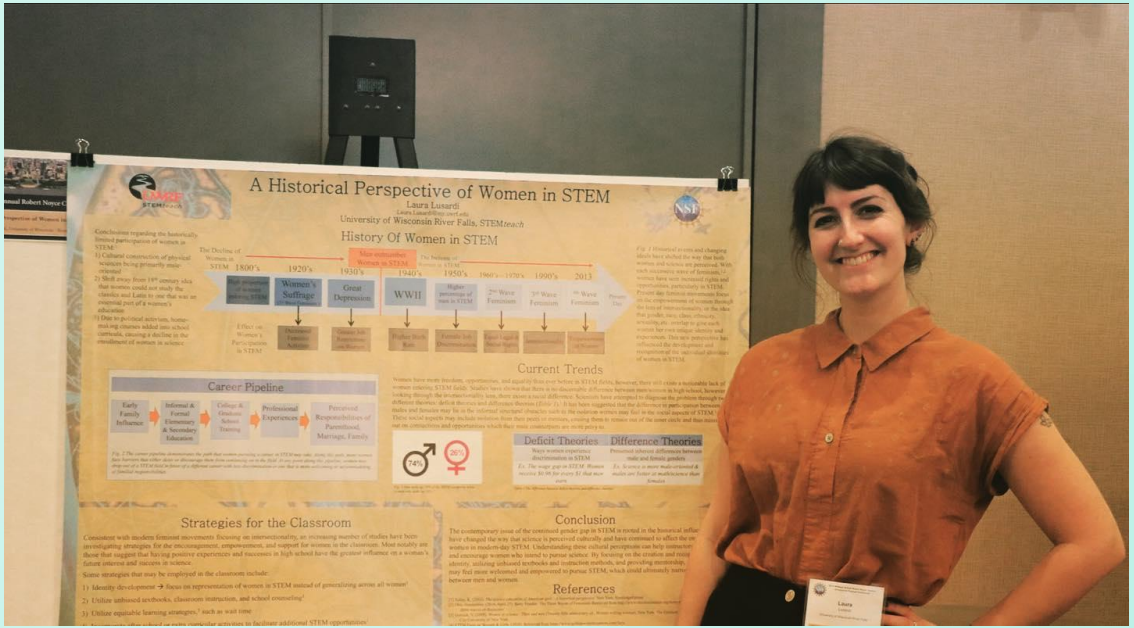


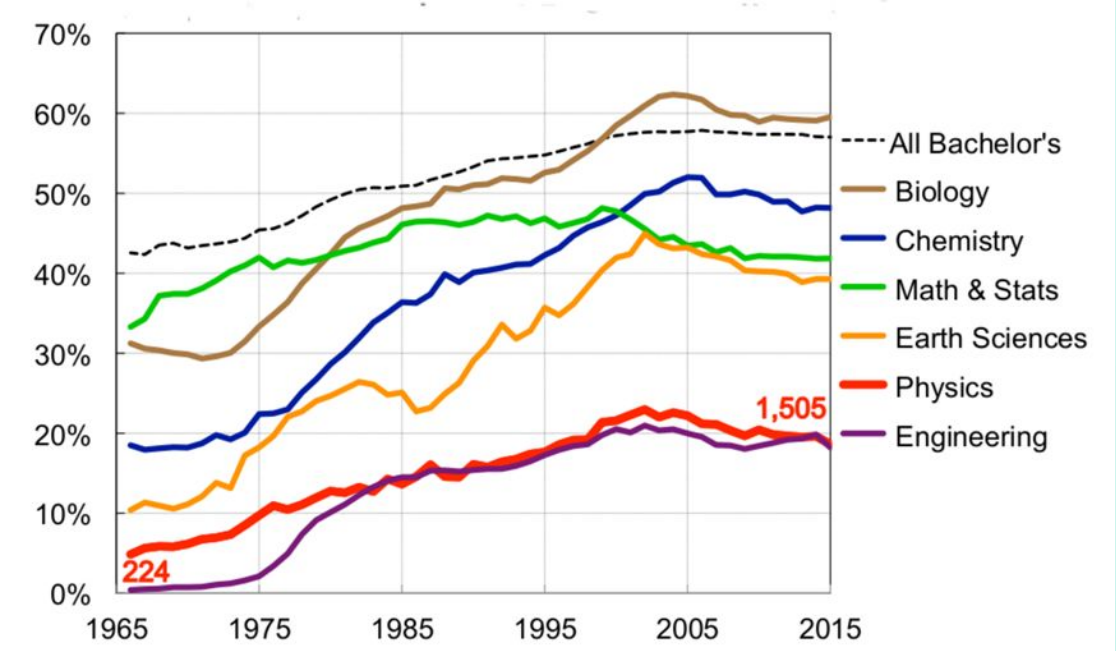
STEP UP Ambassador, fellow physics teacher, Wisconsin school system grad (K-12 & college/grad school)

STEP UP

STEP UP is a national community of physics teachers, researchers, and professional societies. We design high school physics lessons to empower teachers, create cultural change, and inspire young women to pursue physics in college.

Website:
https://engage.aps.org/stepup/home

Percentage of Bachelor's Degrees Earned by Women/Major



Source: APS & IPEDS Completion Survey

- Physics/engineering have the lowest percentage of women
- To close the gender gap, we need 18,000 more women to graduate with physics degrees

STEP UP aims to help close this gap

Future Scientist From the Beginning

Kindergarten

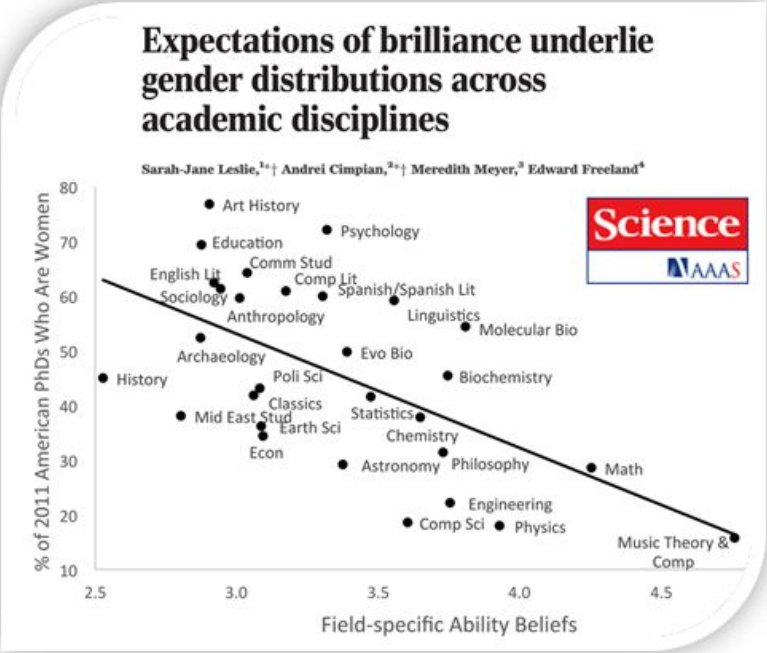
1st Grade

2nd Grade


"Oh, then you're *smart*"
"Physics is *SO* hard!"
"I could *NEVER* do physics"
"You don't *look* like a physicist"
"AND you're a *woman*"
IceCube
Extreme Astronomy in Antarctica
WIPAC
Wavelength Dependence of Optical Properties of
Ice in the IceCube Neutrino Detector

The Data: Academic Achievement & Bias

- Men & women achieve similar grades in high school & university physics
- Science & math achievement is nearly the same between boys & girls (varies more with country than gender)
- In U.S., girls age 6 are less likely than boys to believe that girls are 'really, really smart'," and avoid activities associated with being "really, really smart"
- The more a field is associated with intellectual ability, the lower the percentage of PhDs held by women



Source: Leslie et al., 2015

We need to cultivate a shift in thinking *before* college.

We need our girls to <u>believe</u> they can do physics as soon as possible.

Research-Based Curriculum

Lesson 1
Careers in Physics

Lesson 2
Women in Physics

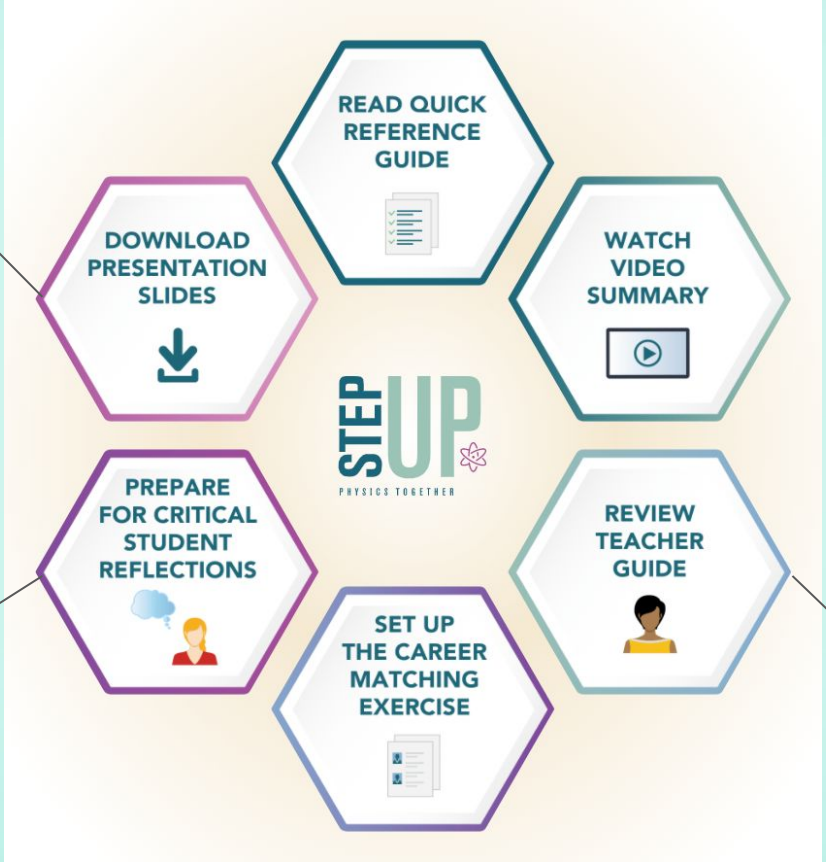
Lesson 3
Everyday Actions (for teachers)

Collectively the lessons work to build confidence, establish a physics identity, increase representation of women in physics, and break down barriers for women in physics.

Lesson Features

Full presentations available (FREE)

Tips for addressing student responses



Critical Lesson Components:
Aspects of the lesson that can't be skipped (per master teachers)

Useful tips for teachers

- Questions to ask
- Ways to structure material
- Critical lesson components

Lesson Components

01

Intro

1 & 2: Identify stereotypes and misconceptions about physics & those who do physics

02

Activity

1. Career Matching
2. Gender Gap Data Presentation

03

Critical Component

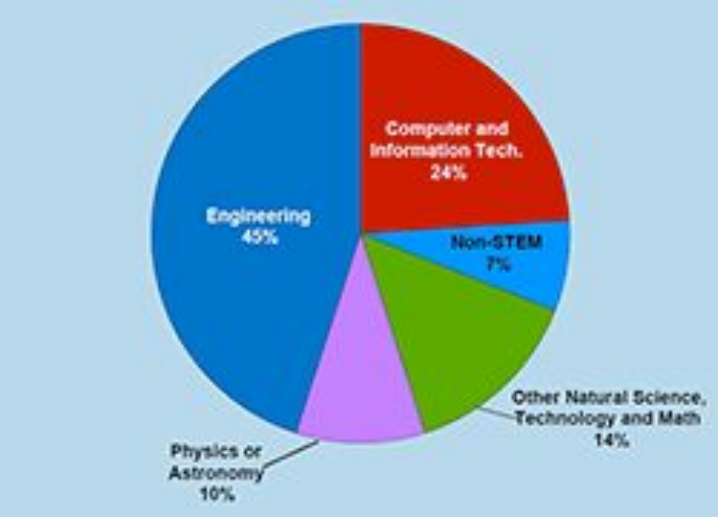
1. Students create physics career profile
2. Students share personal experiences

01

STEP UP Lesson 1

Careers in Physics

Overview & Purpose



- Discusses the tools, jobs, and opportunities that physics has to offer
- Focuses on the benefits to society & helping others
- Highlights surprising facts & data about the application of physics
- Helps students to envision themselves in a physics career

Virtual Example

padlet

REMAKE SHARE

Laura Lusardi + 18 • 1mo

(P2) What careers can you have with a physics degree?

List three (3) careers that you think physicists can have.

Anonymous 1mo
Zach
engineer teacher

Anonymous 1mo
Faith
science
teacher
engineer

Anonymous 1mo
Sam
engineer
teacher
physicist

Anonymous 1mo
King
Chemist, Biophysicist, Veterinarian

Anonymous 1mo
manyok
doctor, teacher, engineer

Anonymous 1mo
Cartez
Doctor,Design engineer,Laser engineer

Suhuur 1mo
Suhuur

Anonymous 1mo
Gideon
doctors,teachers

Anonymous 1mo
doctor,teacher,scientist

Anonymous 1mo
Alexis
Science writer, teacher, engineer

Anonymous 1mo
Ana
A physics teacher, doctor, engineer

Anonymous 1mo
Kyha
Teacher, Scientist, doctor

Anonymous 1mo
Salahudin
1.engineer
2.Astronomer
3.doctor

Anonymous 1mo
Abubakr
Astronomical scientist, science teacher,

Anonymous 1mo
matt
physics teacher,
plumber, electrition

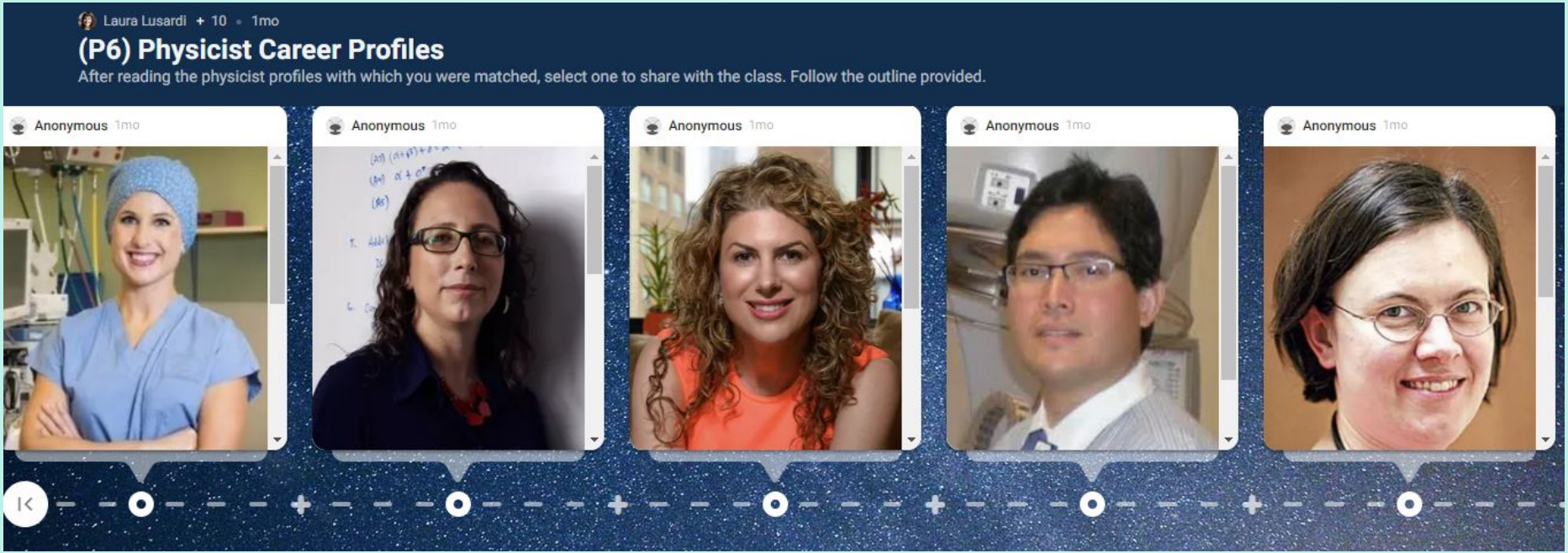
Anonymous 1mo
Prince
astrophysicists, astronomer, teacher

Anonymous 1mo
a Astronomist,scientist,doctor

Anonymous 1mo
Abdi

+

Career Matching



Students are matched with scientists that share the same interests & values students marked in the survey.

Scientist matches are predominantly female

Great to use at the beginning of the year!

Physics Career Profiles: Student Samples

Palak
Astrophysicist

Who I Am
My career is as an Astroparticle Physicist or a particle astrophysicist.

Why Physic
I want to disco ... ut the universe and n ... universe. I wa ... nd how they are forme ... d. I want to figure out h

Using Physi
My career is a ... Understanding ... can help me under ... elp me better underst ... ant subject that I

Advice For
Pay attention in class so you learn more about physics and how you can apply it to your future career. Be creative and be a hard worker. Don't give up and keep learning more.

Palak
Career: Astrophysicist

Physics: Better understanding of universe & formation of planets

Taryn
Marine Biologist

Who I Am
I am a Marine Biologist and my family values education and how you get to the job you want to pursue. I wanted to be a Marine Biologist because I have always had an affinity for the water ... but more speci ... em. I never knew ... letely different. T ... to do that.

Why Phy
I became i ... o reach my career ... ow animals an

Using Ph
Physics car ... nment through th ... other animals or ... those species.

Advice For Students
Physics is in a lot of things and can most likely help you achieve your dream job. Even if you don't know it try to see if taking a class in physics helps you achieve your dream job.

Taryn
Career: Marine Biologist

Physics: Movement of creatures underwater

Lillie
Family Lawyer

Who I Am
My name is Lillie Franklin. I am African American and Native. I was born and raised in America, Minnesota. I think my background is important to me because I never really see any black natives at school and I think if I can be in a career like this and thrive to help the people that need me I feel like I can be successful.

Why Physics
I became interested in Physics when I found out that you need physics in order to be a lawyer. I need to earn my Physics degree and Mathematics degree because those two are my highest things in class of course I need others too but for now those are my main. I first got into physics in 8th grade, now I'm taking it in 9th grade.

Using Physics
I feel ... ts body ... use it for yo ... and body

Advi
If you ... at you want ... sics was s ... tremely impor

Lillie
Career: Family Lawyer

Physics: Problem-solving skills

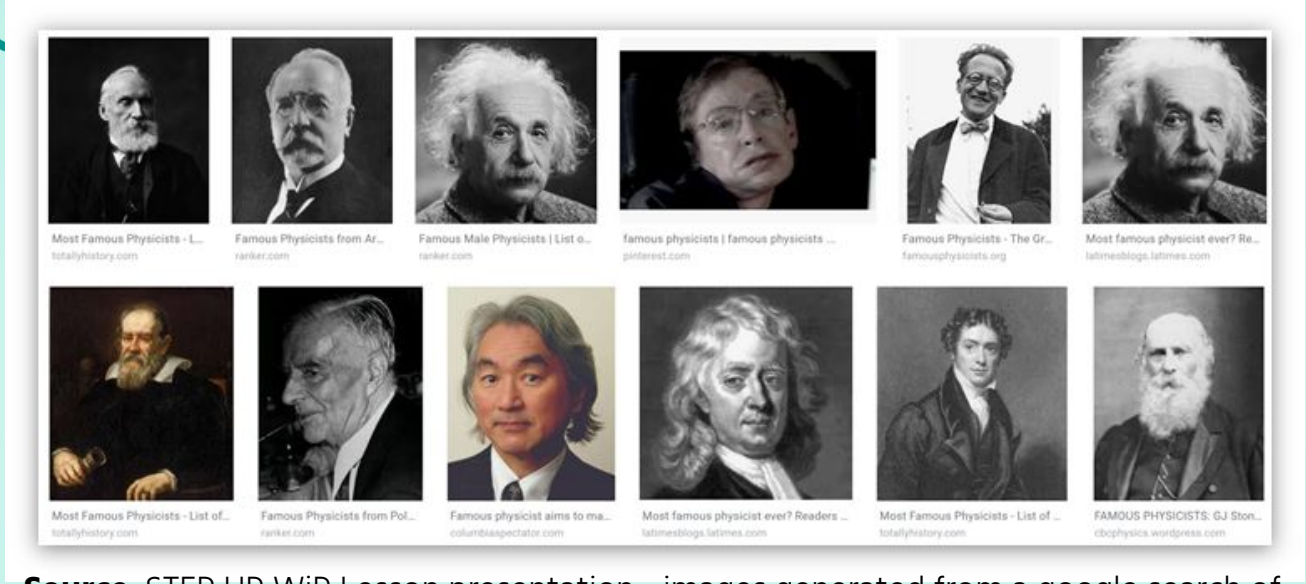
"I was extremely surprised that physics was helpful for law"

STEP UP Lesson 2

Women in Physics

02

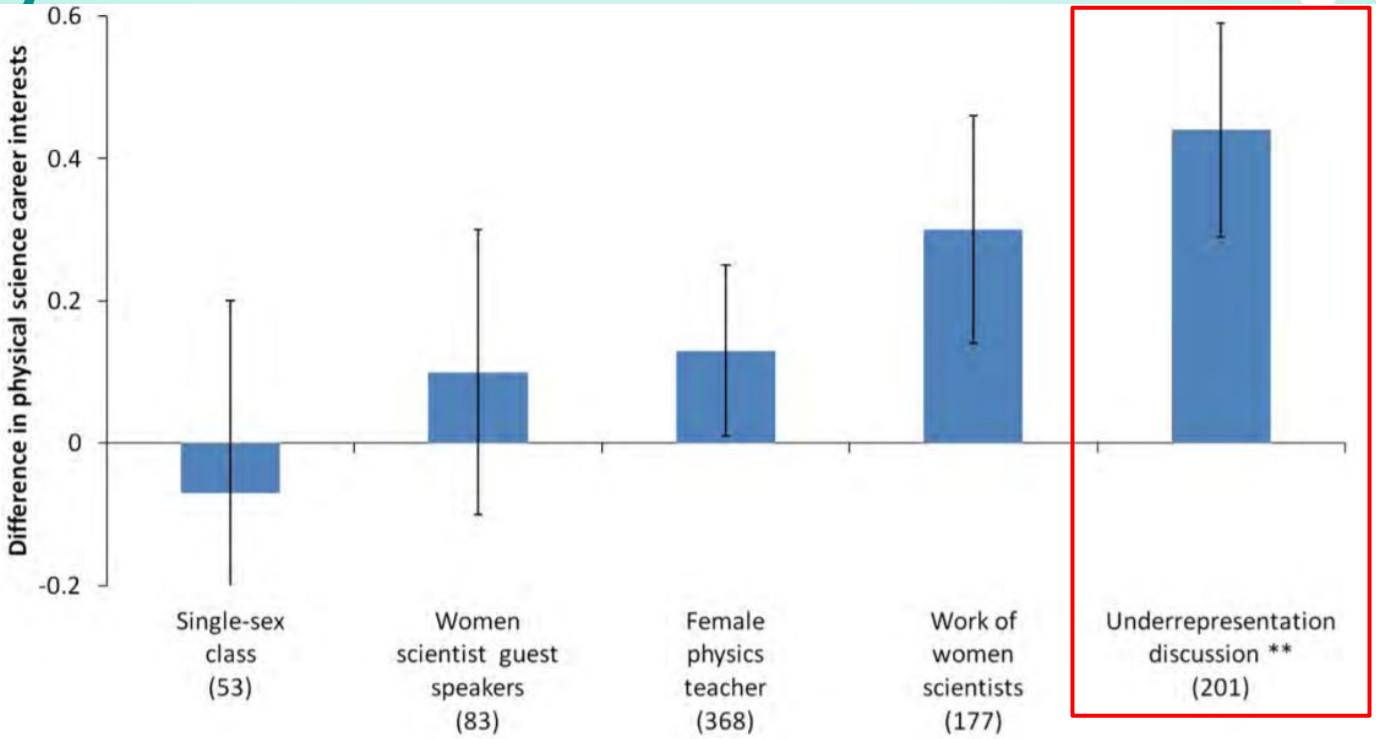
Overview & Purpose



Source: STEP UP WiP Lesson presentation - images generated from a google search of "famous physicists"

- Aims to identify stereotypes and prejudices regarding physics and who can do physics
- Introduce & discuss unconscious bias
- Highlight & discuss the research/data of women in physics
- Increase representation of women in physics

Effects of Discussing Gender in Physics

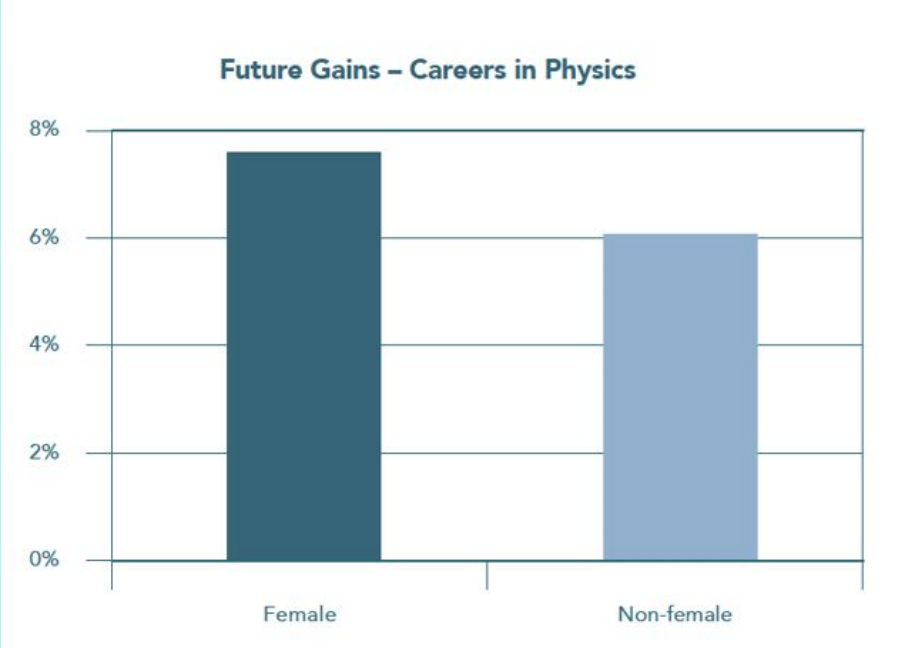


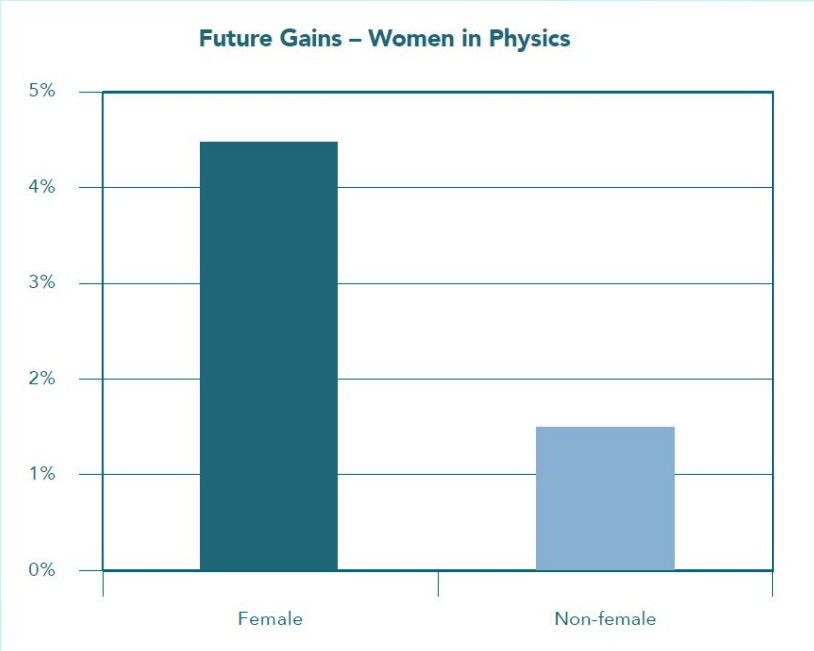
Hazari, Potvin, Lock, Lung, Sonnert, and Sadler, "*Factors that affect the physical science career interest of female students: Testing five common hypotheses*," PRST PER 9 020115 (2013)

All Students Benefit

Both female and non-female students benefit from these lessons by improving students' future physics intentions:

- Majoring in physics
- Pursuing physics-related careers





Credit: STEP Up Careers in Physics & Women in Physics Lesson Teacher Guides

STEP UP Lesson 3

Everyday Actions

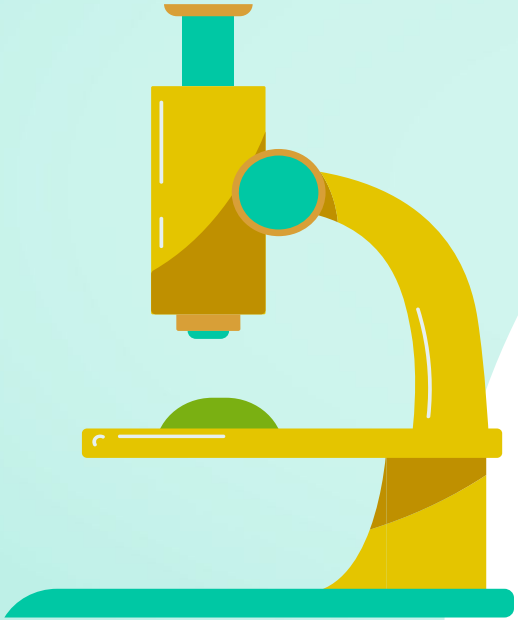
Overview & Purpose

Student Story

"One year my teacher recommended that I apply for a summer internship at Yale. I didn't get the internship, but it was encouraging to me that he thought I was good enough to be competitive."

- Tools for teachers to implement in their classrooms every day to encourage more young women to pursue physics
- Questionnaire to self-evaluate actions you take in/out of the classroom to promote equity
- Example scenarios between teachers, students, and other staff and how to have discussions about opportunities in physics

Self-Questionnaire About Classroom Interactions



5 Different Action Areas:

- Talking to students individually
- Facilitating group work/labs
- Addressing the whole class
- Considering planning & assessing
- Actions outside of the classroom

Everyday Actions Examples

1. Direct students toward clubs, camps, internships, etc.
2. Connect with students about interests & values

Individual Interactions

1. Avoid isolating women in predominantly male groups
2. Teach collaboration skills during/prior to group activities

Group Work & Labs

1. Incorporate real world physics examples
2. Allow second chances for high stakes assessments

Planning & Assessing

1. Encourage other teachers/staff (counselors) to recommend physics to female students
2. Provide parents with information about job opportunities in physics

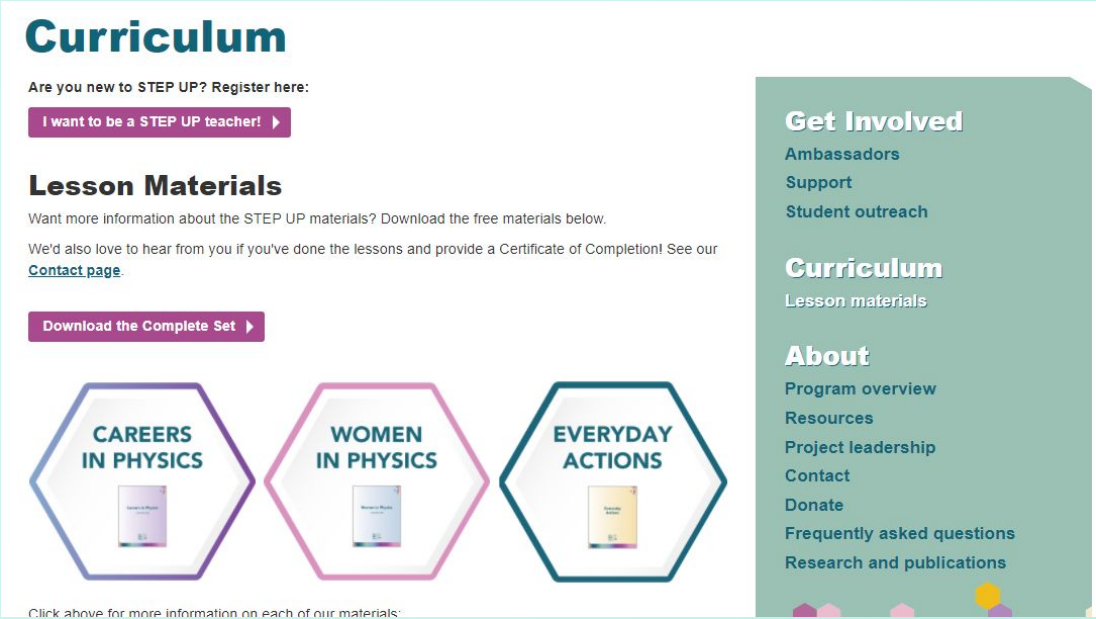
Outside the Classroom

STEP UP Website

Curriculum Materials

Under the Curriculum tab, you can find the three STEP UP lessons

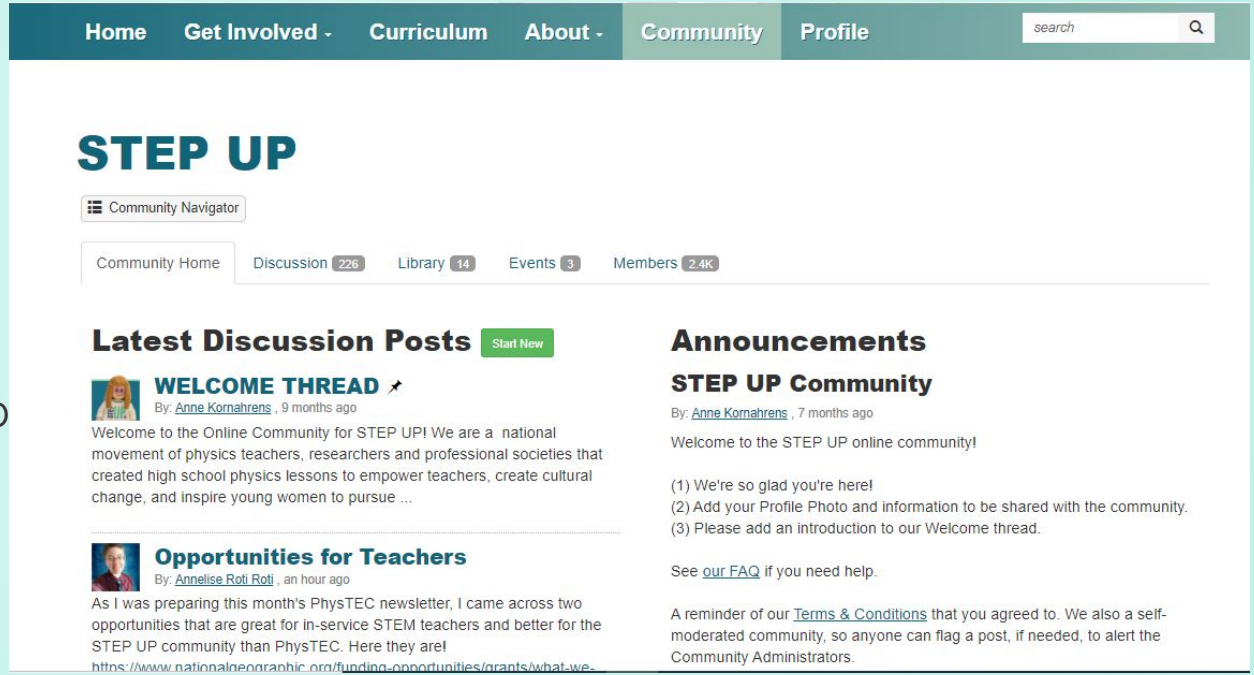
- Lessons are free to download & use



STEP UP Community

Optional: Sign-up (free)

- Access to STEP UP community (2.4K+ members)
- Virtual lesson adaptatio
- Additional resources
- Discussions
- Events



Summary

STEP UP aims to provide students (and teachers) with the tools to be:

- Prepared
- Empowered
- Inspired
- Resilient

... in their future careers, physics or not.

If every physics teacher encourages <u>one</u> female to pursue physics in college, there would be <u>no</u> gender gap in physics.

THANKS

Do you have any questions?

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715-410-7323

STEP UP Website:
https://engage.aps.org/stepup/home

Resources

APS and IPEDS Completion Survey, www.aps.org/programs/education/statistics/womenmajors.cfm

Leslie, S. J., Cimpian, A., Meyer, M., & Freeland, E. (2015). Expectations of brilliance underlie gender distributions across academic disciplines. Science, 347(6219), 262-265.

STEP UP: https://engage.aps.org/stepup/home

Tesfaye, C.L., & Mulvey, P. (2012). Physics Bachelor's Initial Employment. American Institute of Physics (AIP) Report. Retrieved from: https://www.aip.org/sites/default/files/statistics/employment/bachinitemp-p-10.pdf