

QUARKNET: STEPUP CAREERS IN PHYSICS

TEACHER NOTES

DESCRIPTION

In this activity students **examine profiles** of professionals with physics degrees, **assess their personal values** in relation to a career in physics, and **envision themselves** in a physics career.

The research on this lesson shows improvement in students' future physics intentions (e.g., majoring in physics in college or intending physics-related careers) in classes across the U.S. (N = 823). Figure 1 shows that both female and non-female students have positive gains from the lesson. In addition, the overall gains from the lesson across all students are positive. (Cheng et al., 2018)

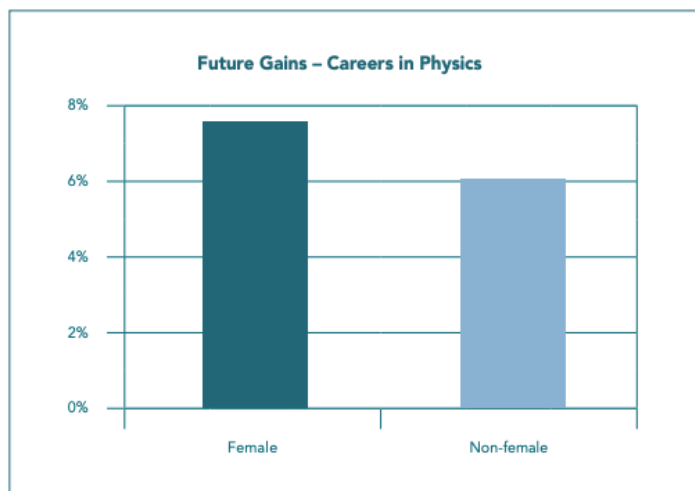


Figure 1. Percentage gains in female and non-female students' future physics intentions (towards majoring/pursuing a career) due to the lesson.

STANDARDS ADDRESSED

Next Generation Science Standards

Appendix H – Understandings about Nature of Science

Science is a Human Endeavor:

- Scientific knowledge is a result of human endeavor, imagination, and creativity.
- Individuals and teams from many nations and cultures have contributed to science and to advances in engineering.
- Science and engineering are influenced by society and society is influenced by science and engineering.

Scientific Investigations Use a Variety of Methods

- Scientific inquiry is characterized by a common set of values that include logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings.

ENDURING UNDERSTANDING

A bachelor's degree in physics opens doors to many careers.

LEARNING OBJECTIVES

Students will know and be able to:

- Identify skills and traits developed by earning a degree in physics.
- Describe ways that a degree in physics supports a variety of careers.
- Create a personal profile to describe how studying physics enhances personal career goals.

PRIOR KNOWLEDGE

None required.

BACKGROUND MATERIAL

Information about the [STEP UP program](#)

Instructional video: <https://www.youtube.com/watch?v=FQ4oNVPc83o>

RESOURCES/MATERIALS

- Sticky notes of two different colors. Each student needs six sticky notes—three sticky notes in each color.
- Class whiteboard, projector, computer

- [Physics Careers and Salaries Presentation](#)

Students need access to one copy of each of the following:

- Career Goals Pre-Survey (Appendix 1), Profile Matching Matrix (Appendix 2) [PDF](#)
- Physicists Career Profiles ([PDF](#) | [Word Doc](#))
- Physicists Career Profiles – [Online Version](#)
- Internet connectivity to research career choices.
- Personal Career Profile worksheets ([PDF](#) | [Word Doc](#))

Career Exploration Web Sites:

- American Physical Society: aps.org/careers
- Compadre: careersinphysics.org/facts.cfm
- Society of Physics Students: spsnational.org/careerstoobox
- American Association of Physics Teachers: aapt.org/resources/Herstories.cfm
- Institute of Physics: <http://www.physics.org/careers.asp?contentid=381>
- U.S. Department of Labor: careeronestop.org/ExploreCareers/explore-careers.aspx
- National Career Development Association: ncda.org/aws/NCDA/pt/sp/resources

IMPLEMENTATION

In this activity you guide your students through the process of **examining profiles** of professionals with physics degrees, **assessing students' personal values** in relation to a career in physics, and **envisioning themselves** in a physics career. Please note that **Task 3** is the most important piece in encouraging students to pursue a career in physics. It is essential that you have your students complete **Task 3**.

Task 1:

Ask your students to brainstorm the answer to the question “What careers can you pursue with a bachelor’s degree in physics?”. Have your students write their ideas on 3 sticky notes of one color, 1 career on each. As the students post their ideas on the board, encourage them to clump together similar careers. Come to closure with this task by drawing your students’ attention to the relatively few categories represented.

Task 2:

This task helps your students think about their personal career goals. Have students complete the Career Goals Pre-Survey to determine areas of interest for their career goals.

Have the students use the instructions in Appendix 2 and the data from the surveys to find physicists with their same values and interests. In small groups of two or three, have your students discuss physicists with which they are matched, what jobs the physicists hold, and what skills are necessary for that job.

Once again, pose the question “What careers can you pursue with a bachelor’s degree in physics?” Have your students use the second color sticky notes to post their answers on the board. There will be a wider array of possible careers posted. Reinforce the idea that a bachelor’s degree in physics opens possible careers by sharing the [Physics Careers and Salaries Presentation](#).

Use the following discussion questions for a class discussion about careers in physics to reflect on how their perceptions of physics careers have changed.

- What surprised you most about what you learned?
- What values and goals do you believe drive these physicists in their careers?
- How do you think these physicists contribute to society and help the world?
- Who do you think benefits from the work of these physicists?
- Can you infer what skills allowed them to accomplish what they did in their career?
- Describe how people who have bachelor’s degrees in physics:
 - Feel about their job stability.
 - Claim job satisfaction compared to people in other fields.
 - Use their physics skills and knowledge in STEM and non-STEM fields.
 - Earn competitive salaries compared to people in other fields.

- Have jobs that can help others.
- Are competitive in admission into medical school or law school compared to people in other fields.

Task 3: Critical Lesson Component

Have your students identify a career in which they are interested. Challenge them to incorporate a physics degree into the pathway to their chosen career. The Personal Career Profile (Appendix 4) provides a template for the key features of students' description of their future careers including physics. Thus, students consider the possibility of a physics degree in a more serious way.

ASSESSMENT

Task 1 and Task 2 lend themselves to formative assessment:

- Students' responses during class discussions of physicists' profiles
- Students' responses to the Career Goals Pre-Survey (Appendix 1)
- Student responses to the discussion questions in Task 2

Since Task 3 is essential to the success of the activity, it lends itself to a summative assessment.

- Personal Career Profile (Appendix 4 – Part 1 and Part 2). You can use the following guidelines for awarding points:
 - Evidence of researching their career
 - Inclusion of a picture
 - Answering the question: Who am I?
 - Answering the question: Why physics?
 - Answering the question: How does my career use physics?
 - Providing advice for students about why physics matters in this career

BIBLIOGRAPHY

AIP Statistics (2016). What's a Bachelor's Degree Worth? American Institute of Physics (AIP).

Retrieved from: <http://www.aip.org/sites/default/files/statistics/physics-trends/fall16-bs-deg-worth.pdf>

Mulvey, P. and Pold, J. (2017). Physics Bachelors: Initial Employment. American Institute of Physics (AIP) Report.

Retrieved from: www.aip.org/sites/default/files/statistics/employment/bachinitemp-p-14.1.pdf

Next Generation Science Standards – Appendix H on the Nature of Science.

Retrieved from: www.nextgenscience.org/sites/default/files/Appendix%20H%20-%20The%20Nature%20of%20Science%20in%20the%20Next%20Generation%20Science%20Standards%204.15.13.pdf

Pold, J. and Mulvey, P. (2016). Physics Bachelors: One Year After Degree. American Institute of Physics (AIP) Report.

Retrieved from: www.aip.org/sites/default/files/statistics/employment/bach1yrafterdeg-p-14.1.pdf

Tesfaye, C. L. and Mulvey, P. (2012). Physics Bachelor's Initial Employment. American Institute of Physics (AIP) Report.

Retrieved from: www.aip.org/sites/default/files/statistics/employment/bachinitemp-p-10.pdf

Tesfaye, C. L. and Mulvey, P. (2013). MCAT, LSAT and Physics Bachelor's. American Institute of Physics (AIP) Report.

Retrieved from: www.aip.org/sites/default/files/statistics/undergrad/mcat-lsat1.pdf