



Expanding the reach of APS PhysicsQuest using STEP UP Principles

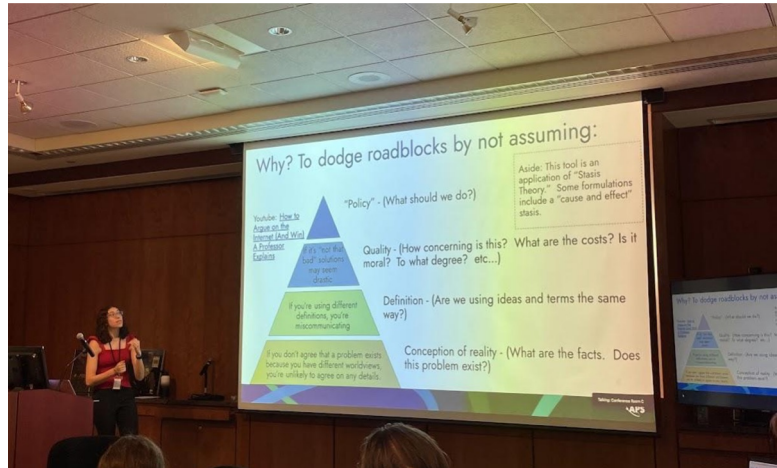
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Three Main Projects:

1. PhysicsQuest Guidelines
2. PhysicsQuest Extensions
3. Facilitate Science Trust Project Workshop

Summer Goals:

- Learn more about physics outreach programs
- Develop curriculum
- Meet APS employees and other teachers



What is APS PhysicsQuest (PQ) ?

- Experiment kits for middle school teachers to use to introduce students to basic physics concepts
- Follows Next Generation Science Standards (NGSS)
- Focus on induction based learning
- Project Goals:
 - Make physics more accessible
 - Expose teachers and students to new physics concepts
 - Engage diverse and underrepresented students
 - Promote engagement in science

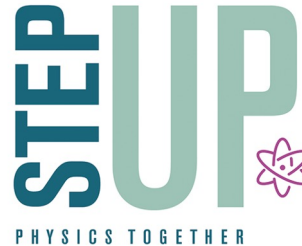
Changes to PhysicsQuest



- Spectra comics found to not engage students as much as planned
- Move away from focusing on old scientists and more towards introducing counternarratives
- Incorporation of STEP UP
 - Stronger focus on pedagogy
 - Increase reach
 - Make physics more available and relatable

What is STEP UP?

- National community of physics teachers that create lessons to inspire young women to pursue physics
- Careers in Physics and Women in Physics lessons
- Everyday Actions Guide (EAG)
 - Strategies for reducing marginalization in the classroom



Women in Physics TEACHER GUIDE

Use the self-reflection below to think about how well your everyday actions support an inclusive physics classroom community. Then, use the Everyday Actions Guidelines on the following pages to work to improve your practice as you support young women in physics. Try choosing one area to focus on each week.

EVERYDAY ACTIONS SELF-REFLECTION

On a scale of 1-5, how would you rate your use of the everyday actions?

	NOT AT ALL	1	2	3	4	5	VERY MUCH
When you talk to students individually, do you:							
Discuss with students why they would be a good fit for physics	0	1	2	3	4	5	
Direct other students to female students for help	0	1	2	3	4	5	
Direct students toward clubs, camps, internships, or other programs	0	1	2	3	4	5	
Encourage students to take advantage of academic opportunities in physics	0	1	2	3	4	5	
Connect with students about what they value and are interested in	0	1	2	3	4	5	
Provide students with feedback, reassurance, and personal stories of struggle	0	1	2	3	4	5	
When you facilitate group work/labs, do you:							
Avoid isolating women in a group of mostly men	0	1	2	3	4	5	
Ensure women are taking active roles	0	1	2	3	4	5	
Booster confidence around lab equipment	0	1	2	3	4	5	
Teach collaboration skills during or before initial group activities	0	1	2	3	4	5	
When you address the whole class, do you:							
Set expectations for success	0	1	2	3	4	5	
Promote a sense of community	0	1	2	3	4	5	
Promote a growth mindset	0	1	2	3	4	5	
Value many different types of skills, such as communication and teamwork	0	1	2	3	4	5	
Eliminate attention during class discussions	0	1	2	3	4	5	
When you plan and assess, do you:							
Incorporate real world physics examples related to helping people/legacy	0	1	2	3	4	5	
Connect physics to other disciplines	0	1	2	3	4	5	
Establish clear grading rules	0	1	2	3	4	5	
Allow second chances for high-stakes assessments	0	1	2	3	4	5	
When you are outside the classroom, do you:							
Encourage other teachers to recommend physics to their female students	0	1	2	3	4	5	
Talk to school counselors to ensure they encourage female students to take physics and consider physics careers	0	1	2	3	4	5	
Provide school counselors with information about the breadth of jobs in physics	0	1	2	3	4	5	
Share female students' successes and capabilities with their families	0	1	2	3	4	5	
Provide parents with information about job opportunities in physics	0	1	2	3	4	5	
Support students who want to start a physics club or take part in physics activities and events	0	1	2	3	4	5	
Find out about outreach and community activities for student engagement and encourage students to participate	0	1	2	3	4	5	

Careers in Physics TEACHER GUIDE

PhysicsQuest Guidelines

What are the PQ Guidelines?

- To be used by future PQ reviewers and developers
- Created to ensure project goals and STEP UP components are included
- Split into 3 main sections

Process

- Met with 3 teachers involved with STEP UP to see what things they would look for in lessons
- Created draft based on recommendations and got feedback

Guidelines Highlights

Guidelines for Developers

We recommend that:

- Recommendations are included for how to facilitate activities with STEP UP methods from Everyday Actions Guide

Guidelines for Extensions

We recommend that:

- Specific links and resources are included
- STEP UP CiP and WiP lessons are included

Guidelines for PQ Team/Reviewers

We recommend that:

- Examples of counternarratives are included
- The activity promotes student development of science identity

Overview: Students start by discussing questions about lightwaves. This will give teachers formative assessment data to determine how much the students may already know about lightwaves and wavelengths. Students will then engage in an experiment where they shine a laser through various cloths, collecting and analyzing data to answer the key question, "Can you find the properties of the light waves coming out of your laser using the pattern formed when you shine the laser through cloth?"

Suggested [STEP UP Everyday Actions](#) to incorporate into activity

- When pairing students, try to have male/female partners and invite female students to share their ideas first
- As you put students into groups, consider having female or minority students take the leadership role.
- Take note of female participation. If they seem to be taking direction and following along, elevate their voice by asking them a question about their experiment.



Safety



Teacher Tips:

- Consider using white boards so students have time to work through their ideas and brainstorm before saying them out loud.
- As students experiment, roam around the room to listen in on discussion and notice experiment techniques. If needed, stop the class and call over to a certain group that has hit on an important concept.
- Consider using the [RIP protocol](#) (Research, Instruct, Plan) for lab group visits and conferring

PhysicsQuest Extensions

- “After the experiment” activities used to further engage students
- Three categories
 - Real World Connection
 - Suggestion for drawing, illustrating, or presenting content in a new way
 - Engineering or Design Challenge
- Connecting to underrepresented students:
 - Encouraging agency, ownership and student voice
 - Communal elements
 - Connection to solving critical problems in communities, broader societies, and the planet.
 - Incorporating ways that girls typically learn science

PhysicsQuest Extensions Cont.

Process:

- Started by reading over the teachers manual to understand concepts at play
- Challenges of creating unique activities
- Once something was found/thought of I would modify it for PQ
 - Change materials
 - Include instructions / YouTube videos
- Progress Tracker

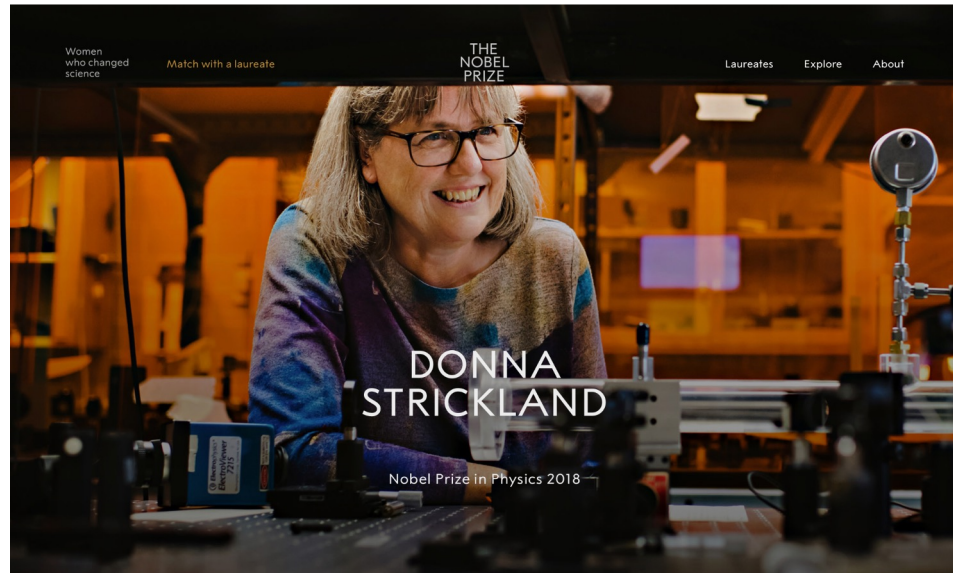
Year	Activity title	Real Word Connection	Suggestion for Drawing...	Engineering/design challenge
2009	Glow in the Dark			
	Hair Thickness			
	Light & Dark Spots, lines, and lasers			
	Swinging Yo-yo Twists & Turns			
2010	Drinking Bird			
	Races			
	Hot Shot Spinner		one from past, not updated yet	
	Meltdown			
2011	Rusted Out			
	Ball vs. donut			
	Color Blockers			
	Hidden Rainbow			
2014	Losing Your Shirt			
	Bendy Light	not updated by me, but on doc already	not updated by me, but on doc already	not updated by me, but on doc already
	Let it Glow!	same as 2009 glow in dark activity	same as 2009 glow in dark activity	same as 2009 glow in dark activity
	Magnifying Marbles			
2015	Circuits			
	Dim the Lights			
	Magnetic Merry Go round			
	Seeing Colors		check to make sure if what I put there is actually physically possible. I think it is but double check if it makes sense	

2017	Straw Trombone			
	Beat Frequency Laser Dance Party			
2018	Talking Tapes			
	Friction			
2019	Straw Rockets			
	Getting Salty			
2020	Getting Warmer/Colder			
	Heat			
	Rusted out and Blown up	same as 2011 rust	same as 2011 rust	same as 2011 rust
	circular motion falling physics swinging science watch it fly			
2023	slinkys			
	multiplexing messages			
	What is the difference between red and blue light? chroma depth glasses			

Real World Connection Extension

PQ 2009: Spots, Lines, and Lasers

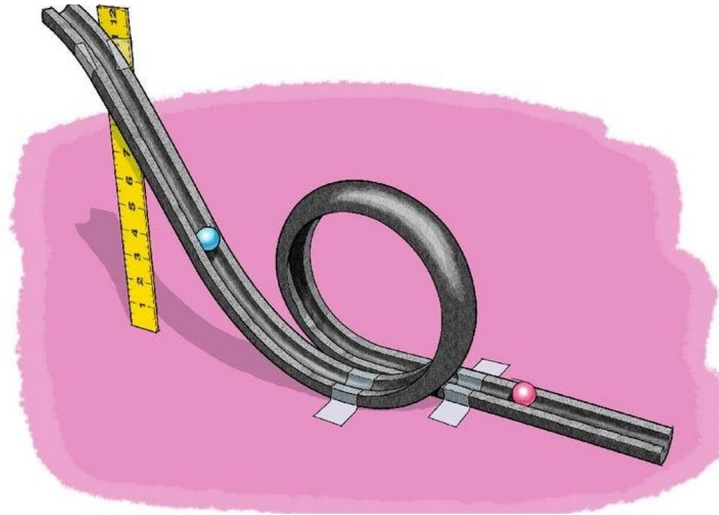
“Have students google search Nobel Prize winner Donna Strickland to learn about her use of lasers”



Engineering or Design Challenge Extension

PQ 2018 Straw Rockets

“In this lab, students should learn about the relationship between kinetic and potential energy. Using this knowledge, students can be placed in groups and tasked with creating a marble roller coaster...”



Presenting Content in a New Way Extension

PQ 2023 Making Waves- Slinkys

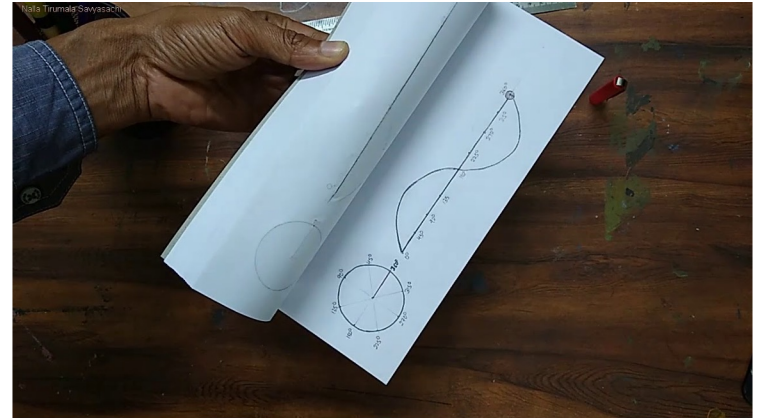
“Act out a wave as a class or create a wave flip book...”



Start

Pause

Resume



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Thank you!

Questions?

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