A Take on Human Capacity Building for the Nuclear Enterprise

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ANS VP/President-elect

ANS Trinity | April 26, 2024

Roadmap

- A little about my work @ NC State University (2001 -) & ANS (2005 -)
- STEM landscape
- Educational ecosystem to engage, recruit & retain
- ANS outreach program
- Discussion

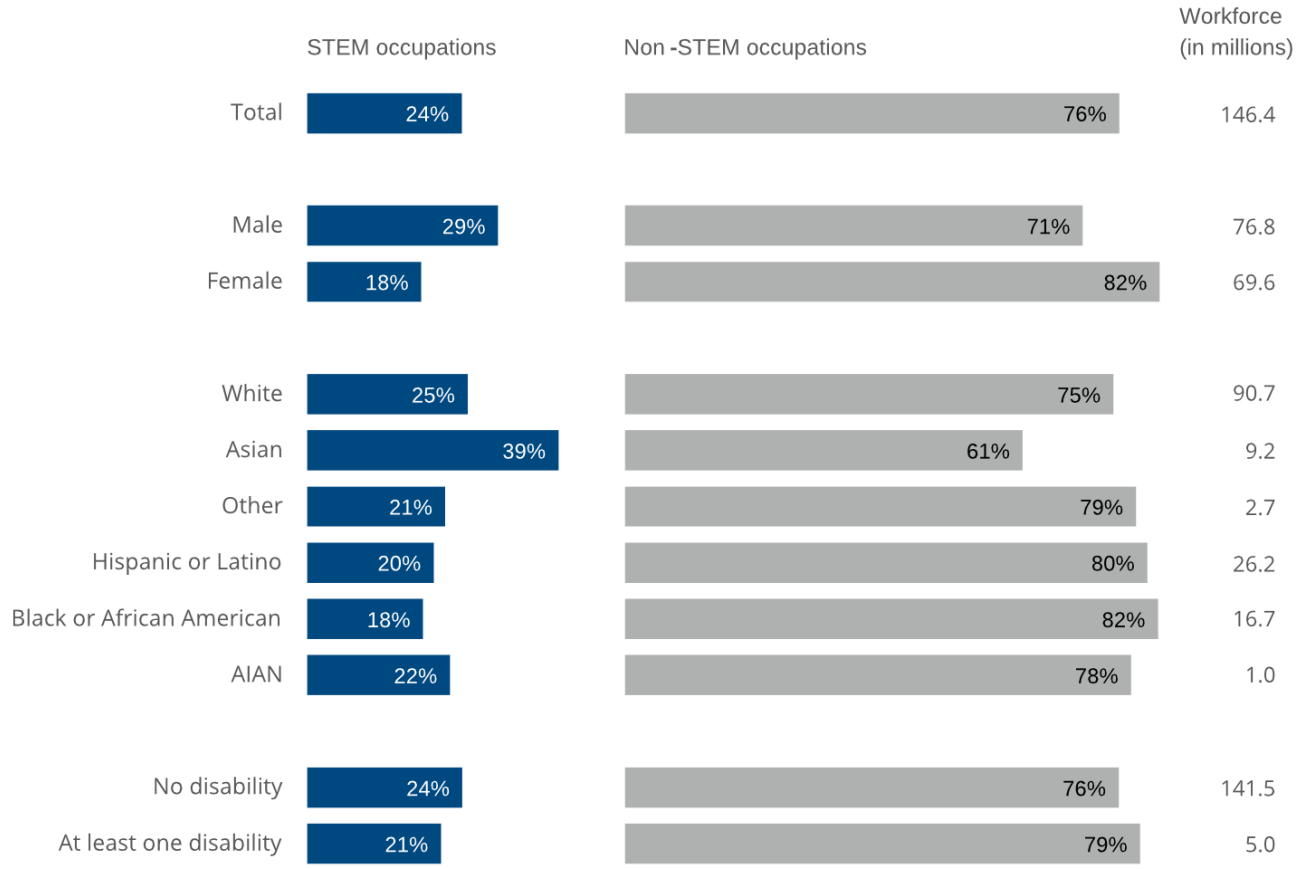
NC State Nuclear Engineering

- Started in 2001 in newly formed position, Director of Outreach
- Outreach → Recruitment → Retention → Engagement
- New student orientation → first-year NE adviser → first-year engineering program
- Co-curricular programming
- Educator programming
- As of January 2023, assistant extension professor
- ANS involvement … IAEA & NEA
- My guiding question: what is needed for a student to thrive?

Workforce Landscape

Figure 2-1

Occupations of the workforce ages 18–74, by sex, ethnicity, race, and disability status: 2021



AIAN = American Indian or Alaska Native; STEM = science, technology, engineering, and mathematics.

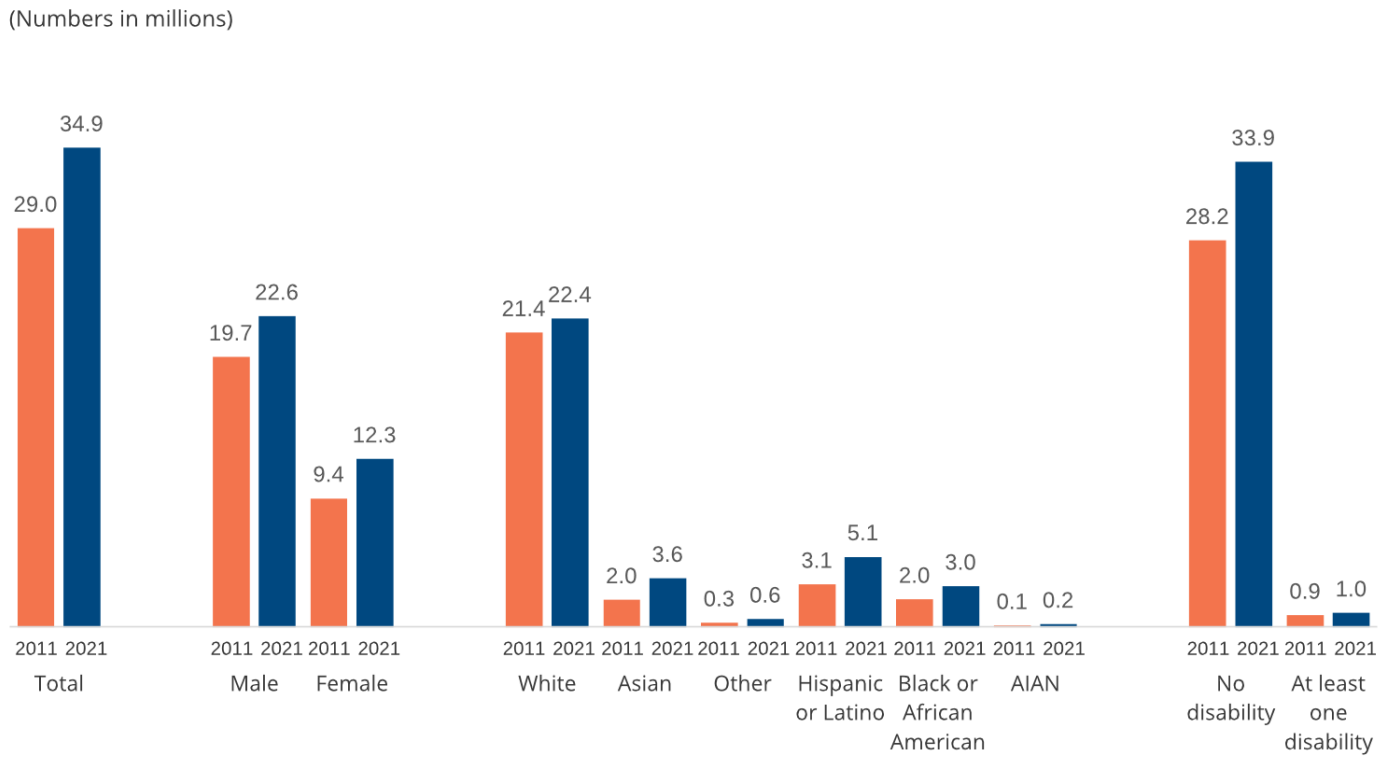
Note(s):
Civilian noninstitutionalized population plus armed forces living off post or with their families on post. Hispanic or Latino may be any race; race categories exclude Hispanic origin. Other includes Native Hawaiian and Other Pacific Islander and more than one race. Respondents can report more than one disability. Those who reported difficulty with one or more functionalities were classified as having a disability.

Source(s):
Census Bureau, Current Population Survey, Annual Social and Economic Supplement, 2021.

STEM Workforce Landscape

Figure 2-2

STEM workforce ages 18–74, by sex, ethnicity, race, and disability status: 2011 and 2021



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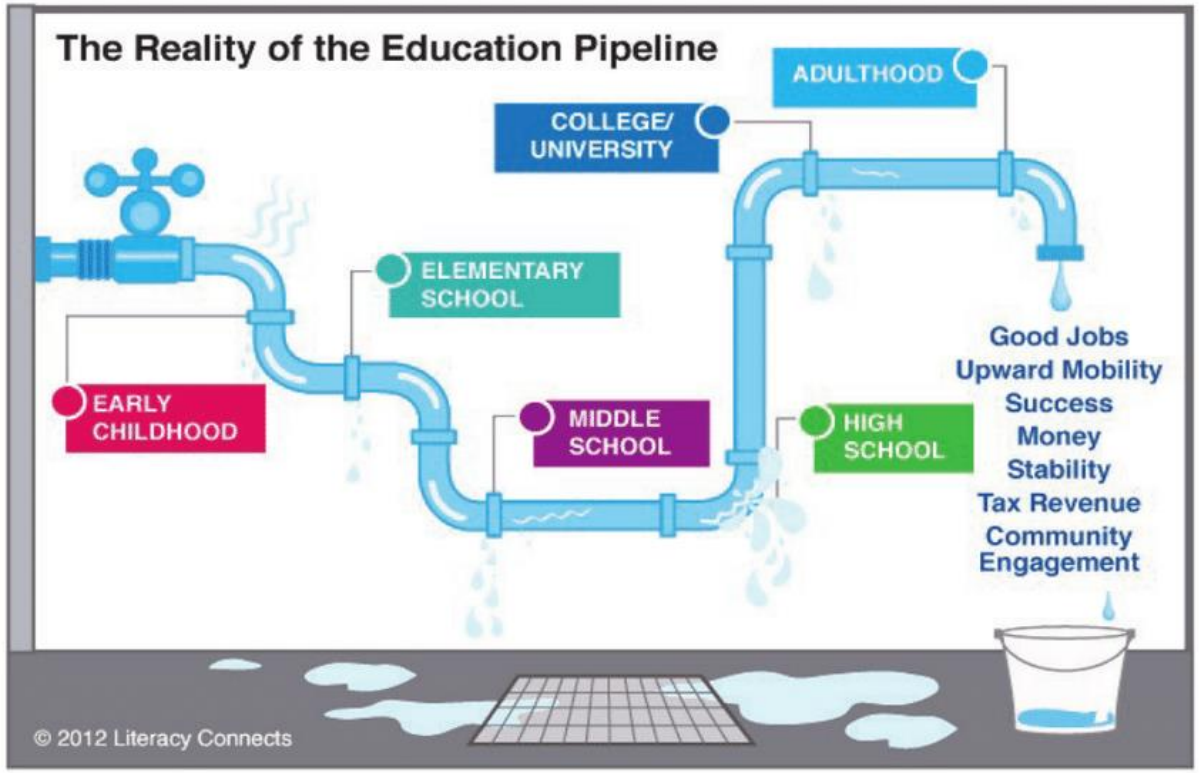
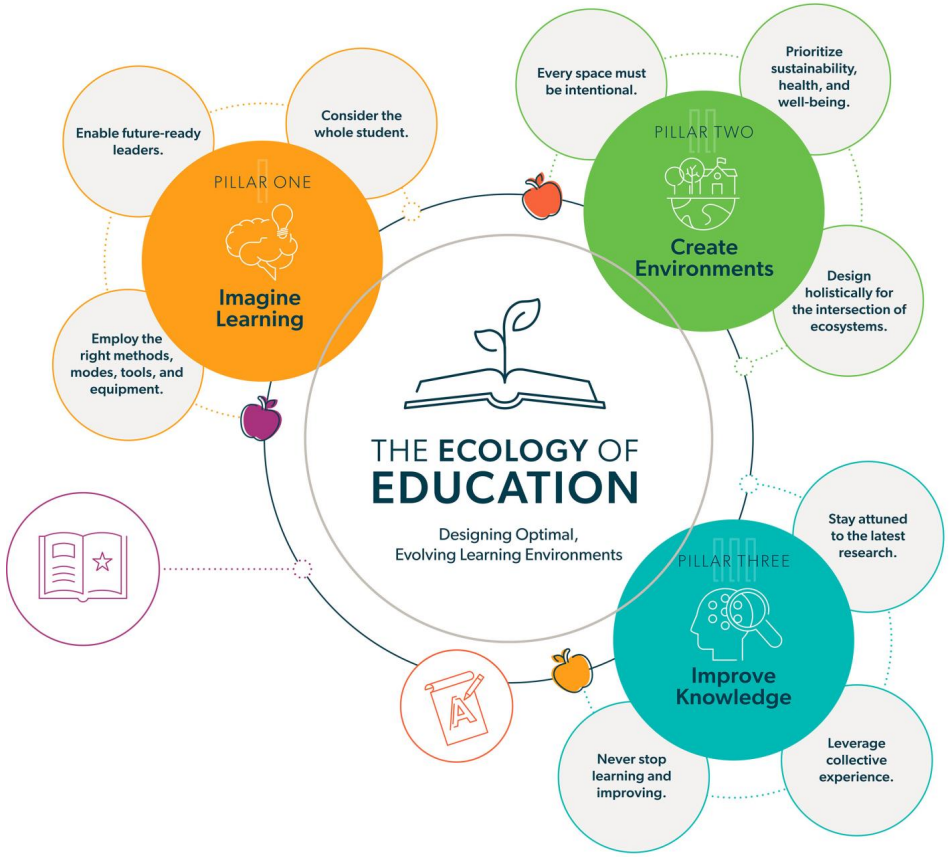
Census Bureau, Current Population Survey, Annual Social and Economic Supplement.

STEM Educational Landscape

- Leaky ‘pipeline’ (illustrative figure)
- STEM career decision-making starts early
- Educational Ecology (Cushing Terrell) …spaces & places of learning





STEM Education Landscape

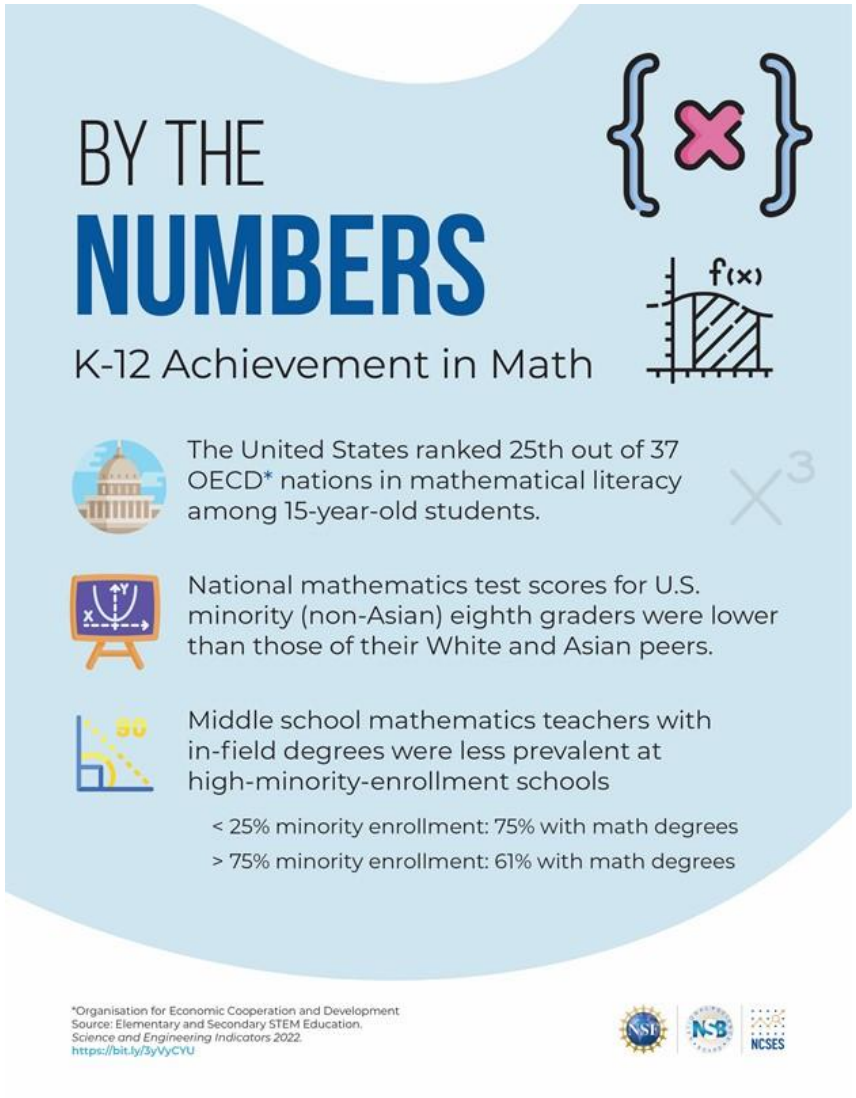
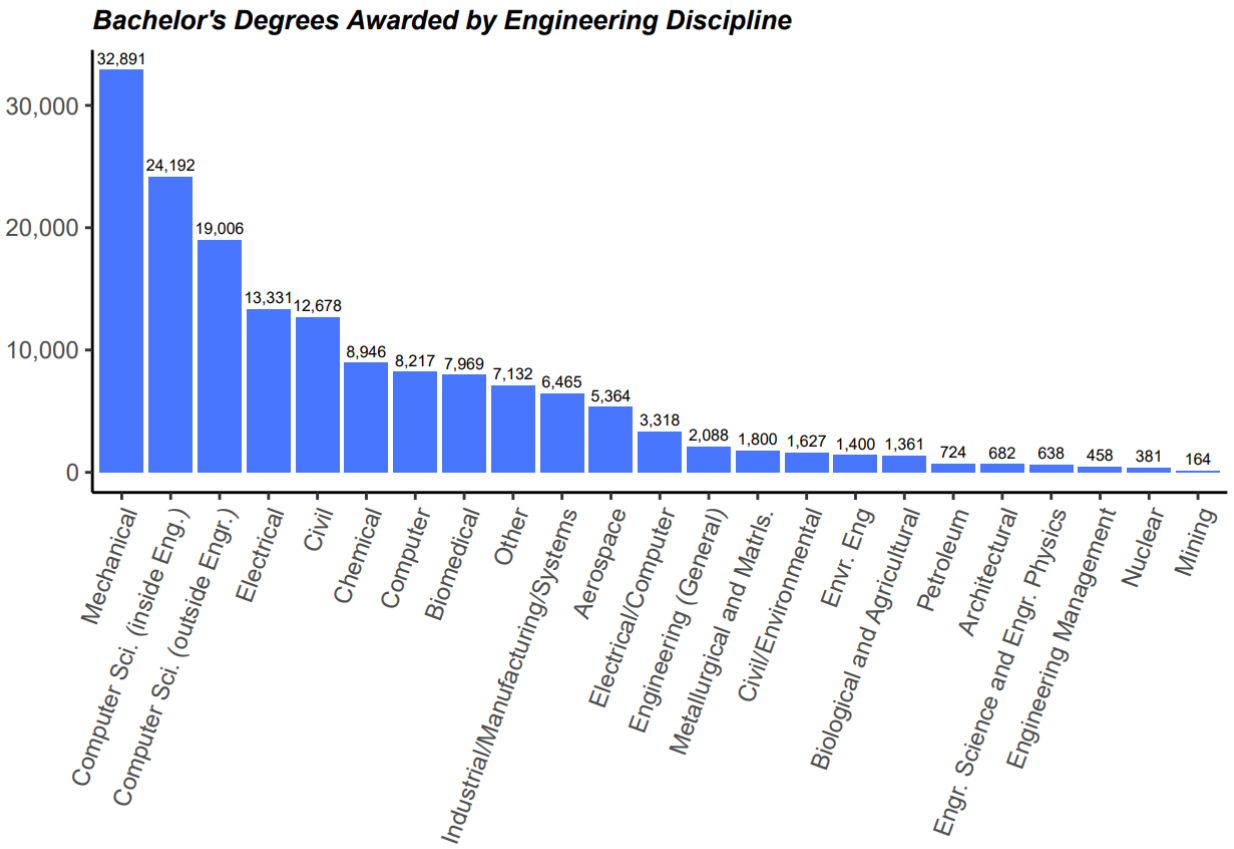


Table 3.
STEM Associate Degrees per Year

	ASSOCIATE DEGREES AT COMMUNITY COLLEGES	
STEM-Transfer		
Social and behavioral sciences	48,340	6%
Sciences and math	44,980	5%
Engineering	5,980	1%
Architecture and related services	510	0%
Total	**99,810**	**12%**
STEM-Tech		
Health professions[a]	119,790	14%
Computer and information sciences	28,040	3%
Engineering/science tech.[b]	20,000	2%
Mechanics and repair	12,080	1%
Agricultural and natural resources	8,310	1%
Other manufacturing[c]	6,260	1%
Total	**194,480**	**23%**
STEM total	**294,290**	**34%**
Non-STEM total	**566,140**	**66%**
Community college sector total	**860,430**	**100%**

Source. Derived from tables in Jenkins and Fink (2023), which are based on 2017 Integrated Postsecondary Education Data System (IPEDS) data using a reclassified definition of "community college" that includes many PABs and is thus broader than the definition of "public two-year college" used in Table 2.
Note. Degrees are categorized differently from majors, so Tables 2 and 3 are not exactly aligned by subject.
[a] Includes related clinical services.
[b] "Tech." includes technologies and technicians.
[c] Includes manufacturing, automotive and aeronautical tech., and intelligence and military security tech.

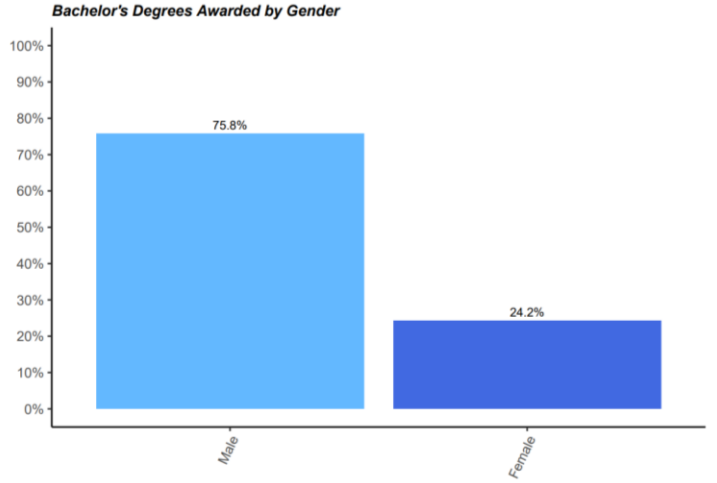
STEM Education Landscape

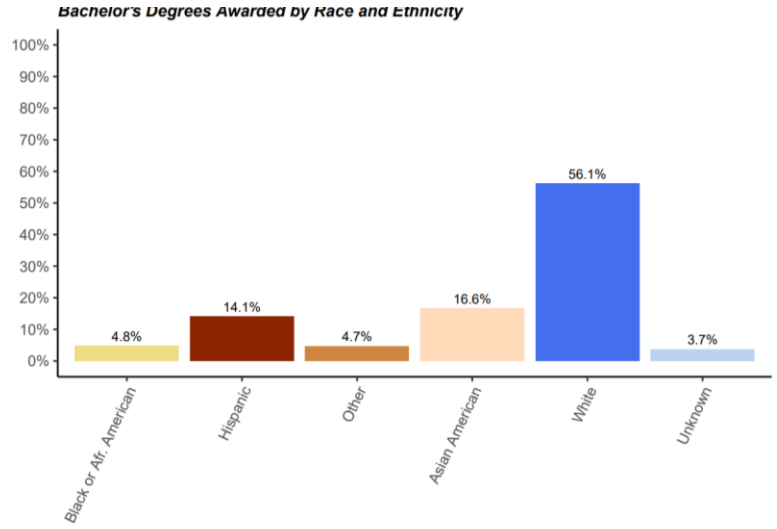


1.1.6 Bachelor's Degrees Awarded by Gender

Table 6: Bachelor's Degrees Awarded by Gender

Gender	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Female	17.80%	18.10%	18.40%	18.90%	19.10%	19.90%	20.90%	21.30%	21.90%	22.40%	23.00%	24.00%	24.20%
Male	82.20%	81.90%	81.60%	81.10%	80.90%	80.10%	79.10%	78.70%	78.10%	77.60%	77.00%	76.00%	75.80%





1.1.8 Bachelor's Degrees Awarded by Residency

Table 8: Bachelor's Degrees Awarded by Residency

Nationality	2010	2011	2012	2013	2014	2015	20	2021
Foreign	6.2%	6.2%	6.7%	7.5%	7.8%	8.5%	.2%	10.6%
Domestic	94.0%	93.8%	93.3%	92.5%	92.2%	91.5%	.8%	89.4%

STEM Education Landscape

The need is known.

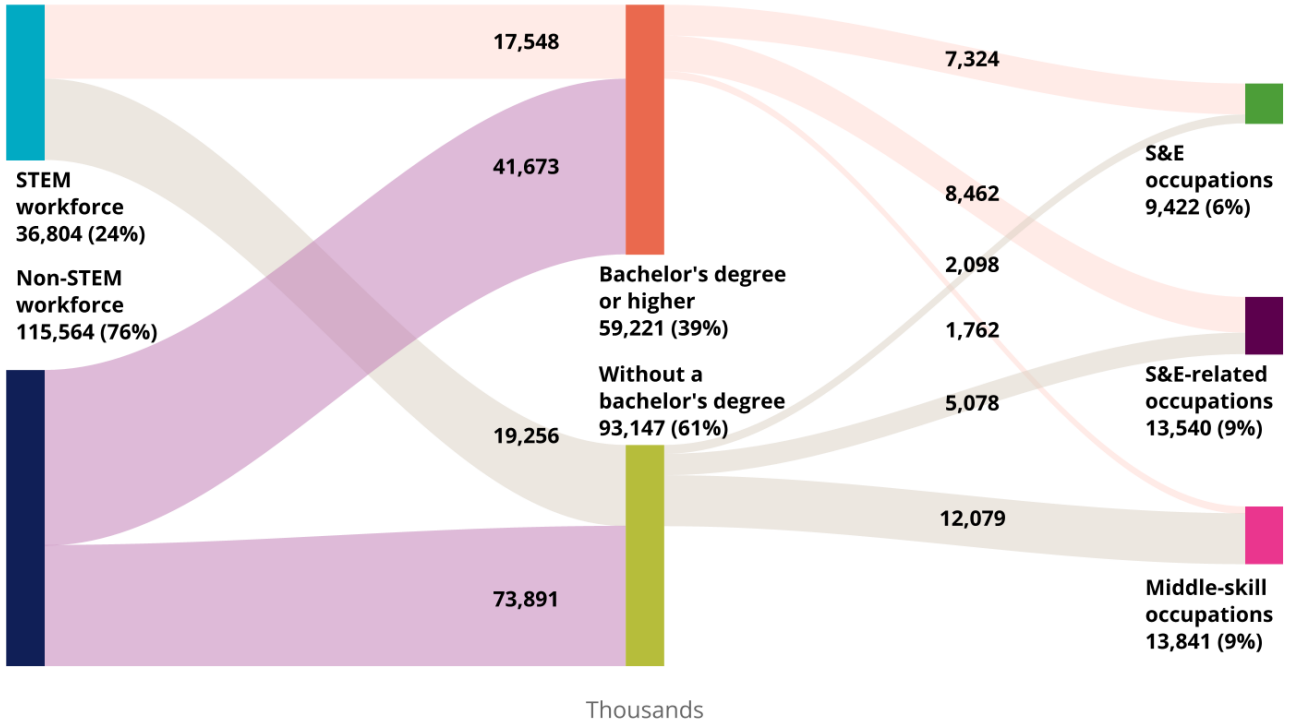
- Liftoff Report (DOE)
- SE Nuclear (E4 Carolinas+)
- EPRI, NEI ... Workforce development strategic plans
- Partnership for nuclear energy
- NSF-Clean Energy Technology (fusion)

How do we engage for STEM? How do we have fuller participation?

National Center for Science and Engineering Statistics | NSB-2024-3

Figure 7

U.S. workforce, by STEM occupation group and education level: 2021



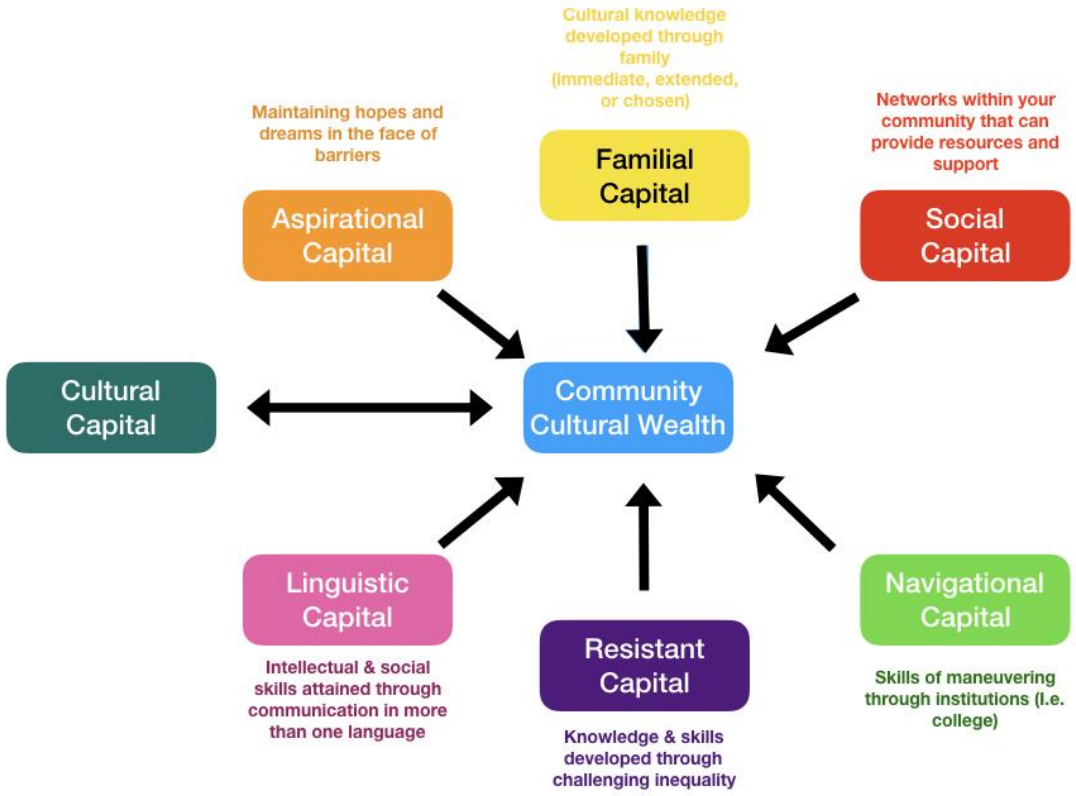
Note(s):
STEM is science, technology, engineering, and mathematics. Numbers are rounded to the nearest thousand. Percent values shown are the shares of the total workforce.

Source(s):
Census Bureau, ACS, 2021.

Indicators 2024: Labor Force

Educational Models

- Deficit models (e.g. blame game)
- Community cultural wealth (Yosso)
  6 types: Social, Familial, Aspirational, Navigational, Linguistic, and Resistant Capital
- Culturally engaged campus communities (Museus)
- Rightful presence in learning and teaching (Barton & Tan)



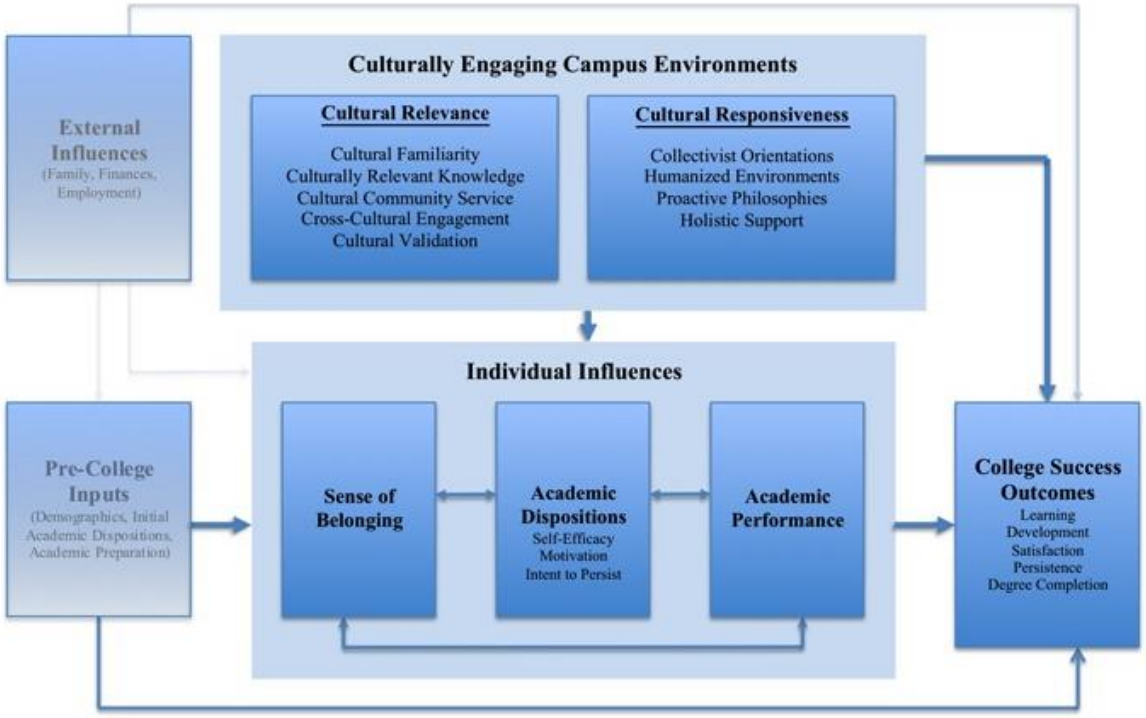
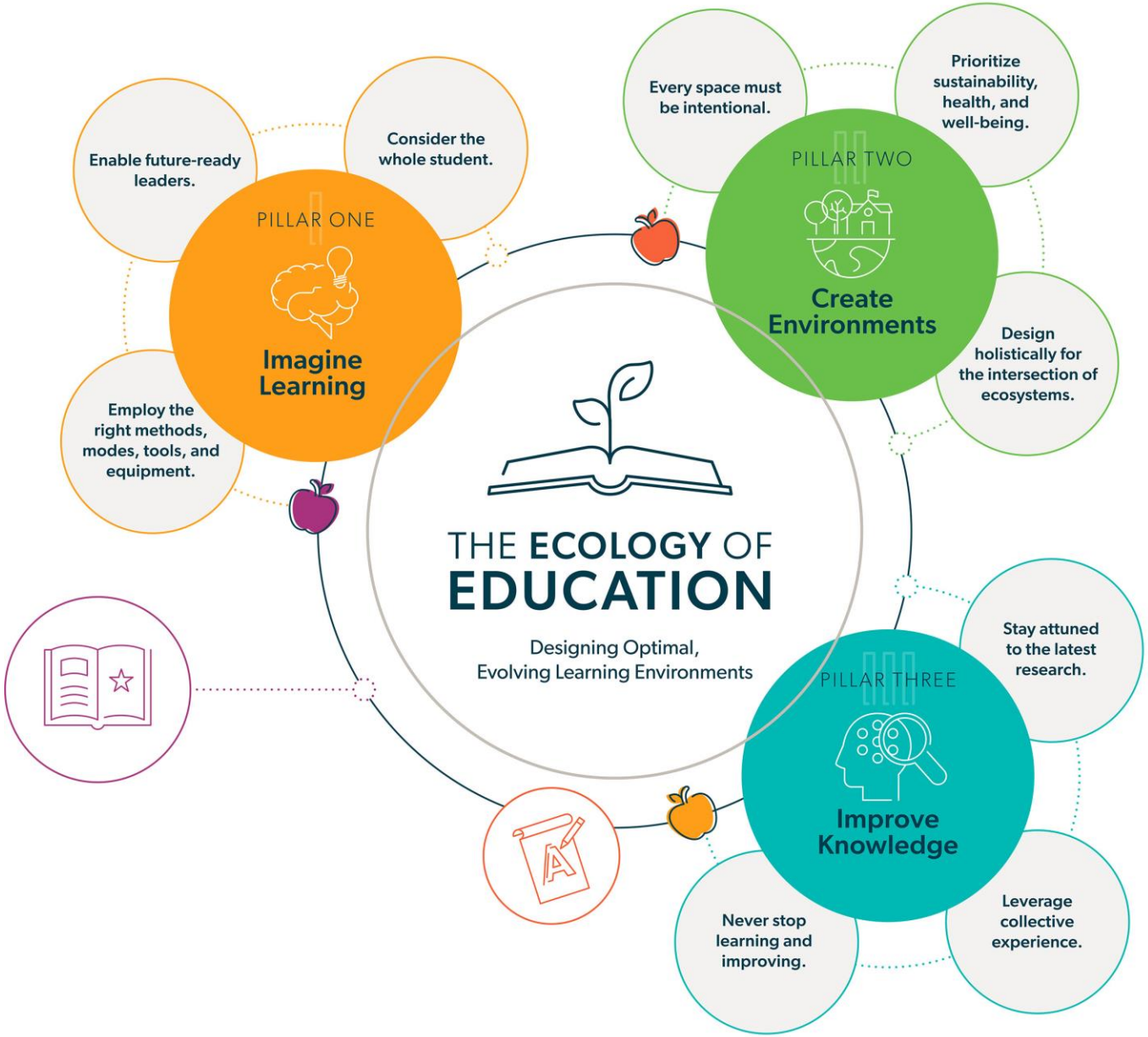


Figure 1: The Culturally Engaging Campus Environments (CECE) Model of College Success


THE ECOLOGY OF EDUCATION
Designing Optimal, Evolving Learning Environments
PILLAR ONE
Imagine Learning
Enable future-ready leaders.
Consider the whole student.
Employ the right methods, modes, tools, and equipment.
PILLAR TWO
Create Environments
Every space must be intentional.
Prioritize sustainability, health, and well-being.
Design holistically for the intersection of ecosystems.
PILLAR THREE
Improve Knowledge
Stay attuned to the latest research.
Leverage collective experience.
Never stop learning and improving.

ANS K-12 Program Goals

- **Clarify common misconceptions** surrounding nuclear science and explore its current and future role in technological applications
- **Build understanding** of and create value for nuclear science and technology
- **Inspire future careers** in the nuclear field – and the pursuit of higher education to achieve this goal

ANS K-12 Programs

- Navigating Nuclear
  - NGSS-aligned nuclear science curriculum for students in grades 3 through 12
- Educator Training
  - Professional development webinars and workshops on nuclear science concepts and teaching strategies
- Pathways To Nuclear
  - Virtual and in-person events to showcase career opportunities and inspire students to pursue roles in nuclear science and technology
- Nuclear Ambassadors
  - ANS members specially trained for classroom interactions

ANS®

Navigating Nuclear

A fact-based, contemporary, and trusted curriculum developed by the American Nuclear Society in partnership with Discovery Education and the Department of Energy Office of Nuclear Energy.

- Fact-based
  - Guided by ANS leaders in nuclear science and technology
  - Reviewed by additional DOE NE SMEs
- Contemporary
  - Resources present the latest in nuclear science and technology
  - Inquiry-based lessons aligned with NGSS
- Trusted
  - Created by Discovery Education curriculum team
  - Featured in subscription resource and free through ANS
  - https://www.ans.org/nuclear/navigatingnuclear/

Elementary 3-5

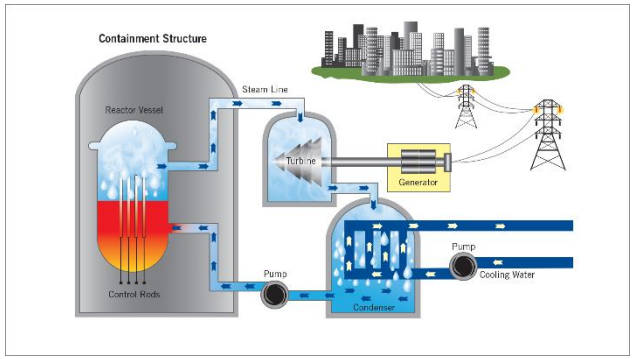
Take a trip to the moon and back through our virtual field trip!

ANS

EDUCATOR TRAINING

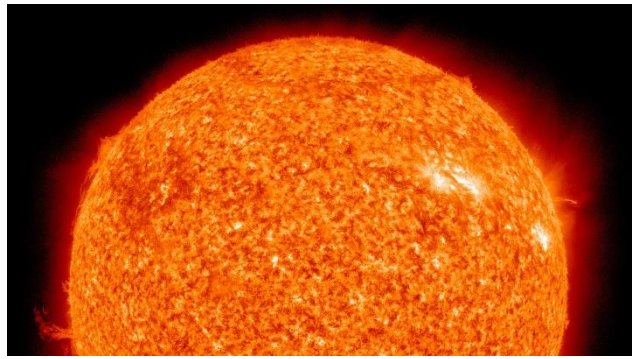
Middle School

Project Starters



From Atoms to Electricity

How does the energy stored in an atom’s nucleus transform into the electricity that powers our lives?



Fusion and Fission: Think Nucleus

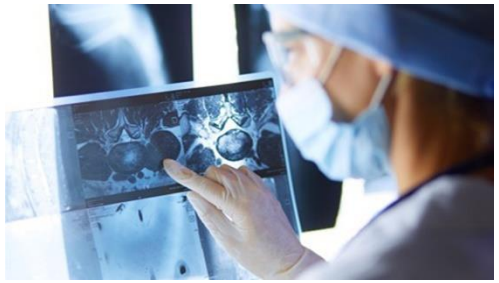
How could nuclear fusion and fission change the way we power our lives?

Radiopharmaceuticals

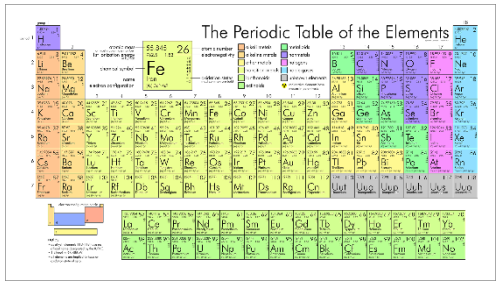
How can a pill that uses radiation help doctors diagnose and treat diseases?

High School

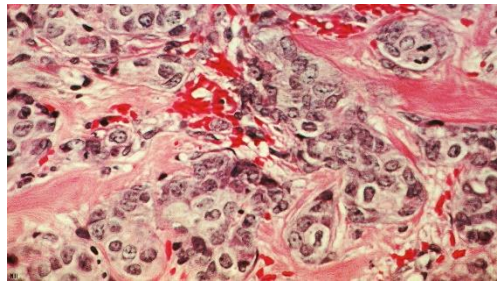
Digital Lesson Bundles (engage, explain, explore)



Realities of Radiation



Decoding Decay



Planting the Seeds for a Better Future for Cancer Patients

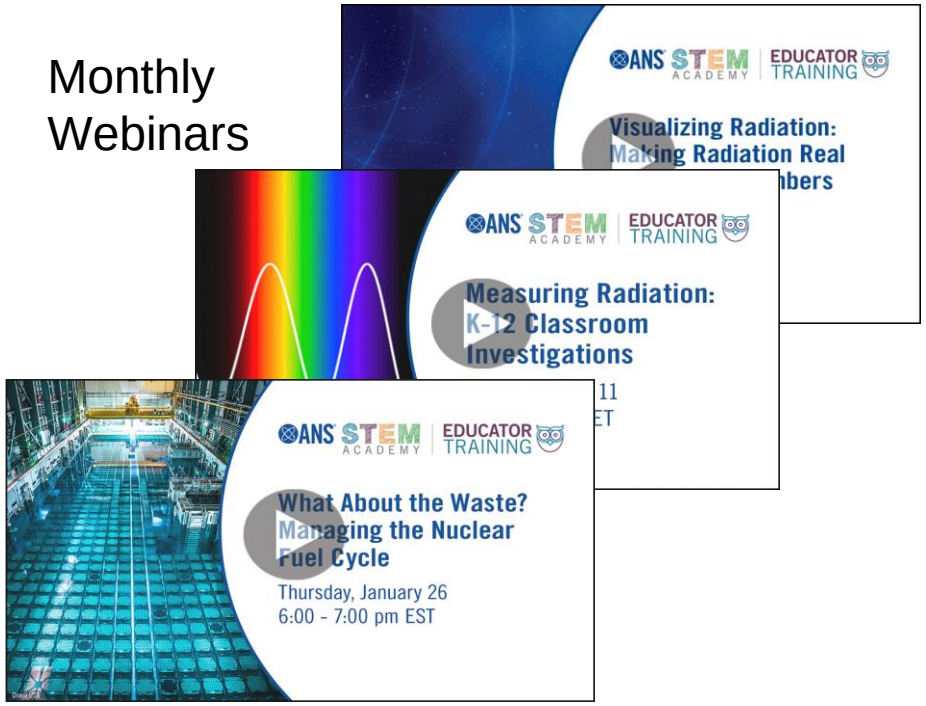
Unlocking Energy: Fission vs. Fusion

Fueling the Future

Educator Training

In-person workshops

Monthly Webinars



- Support for Navigating Nuclear
- Lab activities and tools

ANS

Pathways to Nuclear

If students can see it, they can be it!

Spotlight on Nuclear Careers

ANS's Young Members Group presents interviews with nuclear researchers and professionals making a positive impact on the world.

Life Sciences

Nuclear science is providing unique solutions to problems in life sciences including medicine and agriculture. Hear Katherina Stapelmann, assistant professor of nuclear engineering at North Carolina State University, discuss her research with plasmas and career in nuclear.

New Nuclear Technologies

Marci Shelton, a senior nuclear engineer at SHINE Technologies LLC. Shelton currently works on the production of radioisotopes for diagnostic and therapeutic applications in medicine, such as cancer therapy and imaging. She talked about her work with SHINE as well as her background in the nuclear industry.

Nuclear Energy

Nuclear energy is an exciting field helping create clean, reliable power. Sarah Camba Lynn, an engineering manager at Comanche Peak Nuclear Power Plant in Glen Rose, TX, talks about her work in nuclear energy.

ANS

Career Profiles

Nuclear Security Researcher →

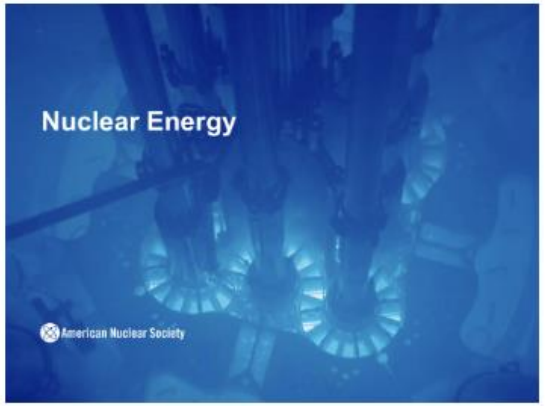
Radiochemist →

Fuels Reliability Engineer →

Nuclear Ambassadors

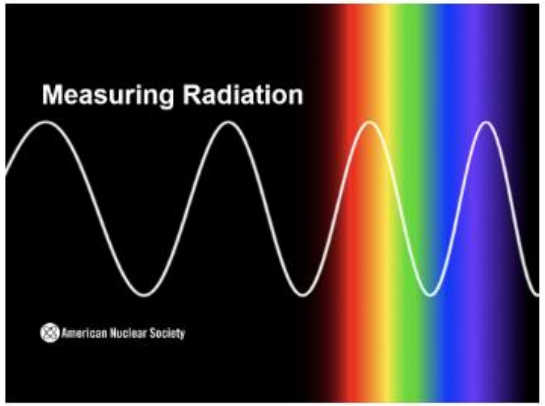
Educational Presentations

Make the complex world of nuclear easier to understand with these presentations. Designed specifically for K-12 students, they provide background knowledge for nuclear science and technology lab activities, such as those in Navigating Nuclear lessons and project starters.



Nuclear energy is a safe, reliable source of clean energy. Introduce students to the facts about nuclear energy and bust some myths, too.

Download



Learn about sources of background and man-made radiation. Then use a radiation monitor to compare radioactive sources.

Download

Radiation is all around us. Cloud chambers are an engaging way to visualize it. Use this presentation to accompany a cloud chamber lab activity.

Download

Upcoming Initiatives

- "One-Way" Cloud Chamber kit ✓
- Virtual Nuclear Ambassadors training
- Future City Nuclear Science Award
- ANS High School Nuclear Club
- International collaborations +

EDUCATOR TRAINING

Thank you!

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