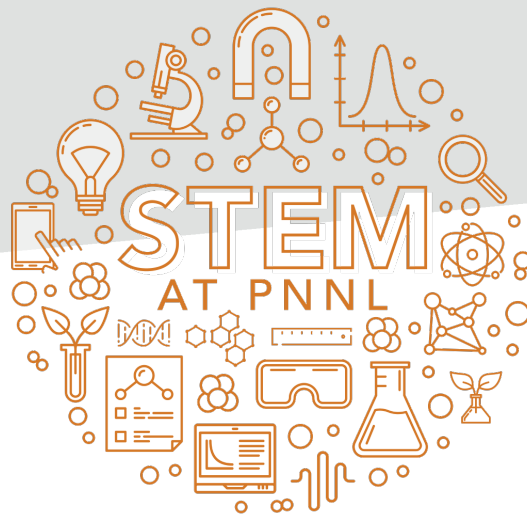




Pacific Northwest
NATIONAL LABORATORY



PNNL Office of STEM Education SIGNATURE EFFORTS



STEM OUTREACH

PNNL aims to increase interest in and enthusiasm for STEM education and careers. Through strategic partnerships and collaborations, we connect with diverse populations to promote and accelerate STEM literacy among students, educators, and our community. We focus especially on reaching individuals who live in rural and historically underserved communities in our region.

STEM Ambassadors: PNNL's signature outreach program, STEM Ambassadors, equips PNNL staff with communication tools and resources to share PNNL's science via hands-on, interactive displays. Our STEM Ambassadors are diverse, representing an array of ethnicities, genders and cultural backgrounds. They serve as role models for the diverse students we seek to engage.



STEM EQUITY AND INCLUSION

To solve tomorrow's complex STEM challenges we need diversity in STEM leadership. That starts with inspiring curiosity and creativity in diverse students today, especially those from underserved communities. Through engaging and culturally relevant STEM education experiences, we can help these students develop STEM habits of mind and a STEM identity, while motivating them to pursue STEM studies and careers.

Mathematics, Engineering, Science Achievement Program (MESA): PNNL leads the K-12 Yakima Valley/Tri-Cities MESA program to provide enriching opportunities in mathematics, engineering, and science for underrepresented students in grades 6–12.



PROFESSIONAL DEVELOPMENT FOR EDUCATORS

Pairing teachers and scientists brings the world of scientific research conducted at PNNL together with the classroom experience, empowering both to have an impact on the next generation of highly skilled STEM workers. Experiences range from one to nine weeks in the field, in the lab, or online, and are aligned with Washington State Science and Learning Standards. We focus on recruiting teachers who can amplify efforts within diverse communities.

Data Visualization Teacher-Scientist Partnership: Enable teachers through hands-on, collaborative learning with STEM professionals to transform data and gain fundamental understanding of data visualization and computer science for integration into the classroom.



COMPUTING SCIENCE EDUCATION

While PNNL understands the importance of increasing participation in all STEM education pathways, the Laboratory particularly emphasizes developing student interest in computing sciences and cybersecurity. Demand for skilled workers in these fields continues to grow. PNNL offers students career-focused learning experiences in computing sciences and provides educators with content workshops and professional development. We leverage our university partnerships to increase the opportunities for, and caliber of, computing sciences education in local and state institutions.

CyberForce Competition: This real-world, scenario-based competition provides the opportunity for college/university teams to test their cybersecurity skills by protecting and defending an industrial control system and its associated corporate network infrastructure. The CyberForce Competition encourages innovative defense strategies and techniques for safeguarding cyber assets.



STEM WORKFORCE DEVELOPMENT

To secure our nation's future prosperity and security, the national lab system plays a critical role in helping prepare the future, diverse STEM workforce. PNNL offers comprehensive internship and workforce development programs for students, specifically targeting underserved populations in high school, undergraduate, or graduate programs. These programs and internships aim to help inspire, grow, and retain students who are pursuing STEM studies and career pathways.

PNNL Gold Experience: This model effort distinguishes PNNL and accelerates the diverse DOE workforce by providing student interns with a trained mentor, on-the-job work experience, and unique and engaging learning experiences. Working alongside their mentors, interns engage in real-world research challenges, while also participating in a suite of professional development and networking activities.

OUR STRATEGIC PARTNERS



COLLABORATIVE PROJECT HIGHLIGHTS

MATHEMATICS, ENGINEERING, SCIENCE ACHIEVEMENT PROGRAM (MESA)



Through close collaboration with the University of Washington and PNNL, the Yakima Valley/Tri-Cities (YVTC) MESA program, on average, annually serves more than 400 6–12 grade students. MESA students participate in hands-on engineering design challenges, STEM activities in their classrooms, and engineering competitions. The YVTC MESA program focuses on increasing the number of underrepresented students pursuing post-secondary education and entering the workforce in STEM fields.

STEM NEXUS INITIATIVE



The STEM Nexus Initiative is a multi-pronged, community-engaged initiative made possible by Battelle's \$1M philanthropic gift to accelerate STEM education within the Tri-Cities community. PNNL is partnering with the Washington State STEM Education Foundation and regional community leaders to create relevant, real-world STEM learning and career awareness experiences for students from underserved communities.

TEACHER-SCIENTIST PARTNERSHIP



The Association of Washington Business, in partnership with PNNL's Office of STEM Education, designed an exemplary professional development program for middle and high school STEM teachers that offers side-by-side, hands-on field learning experiences with PNNL researchers. This immersive experience aligns with national science and computing education standards, so teachers can apply their experiences to their classroom lessons.

CYBERSECURITY WORKFORCE DEVELOPMENT



PNNL partners with the Department of Homeland Security Cybersecurity and Infrastructure Security Agency around a mutual aspiration to increase the cybersecurity workforce by sparking the interest of K–12 students in and out of the classroom. This shared aspiration resulted in expanded strategic partnerships to develop a suite of educational games and deploy them to youth nationwide (in progress).



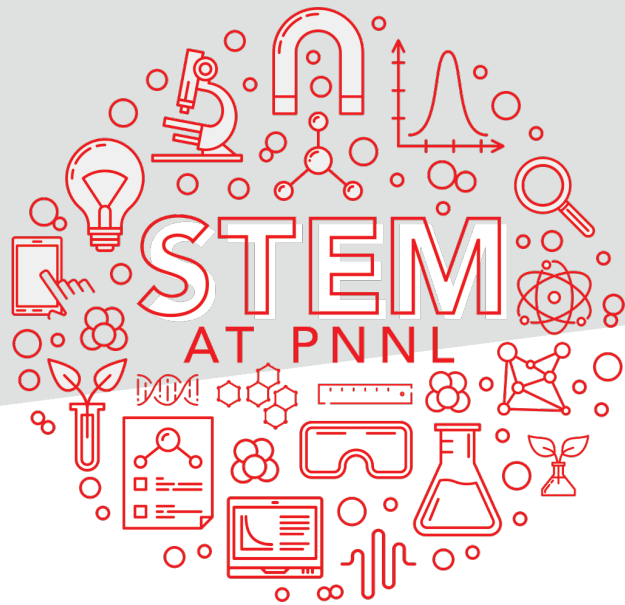
www.pnnl.gov/stem



stem.education@pnnl.gov



This effort aligns with the U.S. Department of Energy's efforts to support and sustain a national pipeline of highly skilled and diverse science, technology, engineering, and mathematics (STEM) workers.



STEM Outreach

PNNL aims to increase interest in and enthusiasm for science, technology, engineering, and mathematics (STEM) education and careers. Through strategic partnerships and collaborations, we connect with diverse populations to promote and accelerate STEM literacy among students, educators, and our community. We focus especially on reaching individuals who live in rural and historically underserved communities in our region.

PNNL's Office of STEM Education implements several educational and outreach programs throughout the region with a variety of community partners. PNNL provides opportunities for students, educators, and the community by promoting exploration of and excitement for the sciences via career-focused, hands-on STEM learning experiences.

PNNL's signature outreach program, STEM Ambassadors, equips PNNL staff with communication tools and resources to share PNNL's science via hands-on, interactive displays. Our STEM Ambassadors are diverse, representing an array of ethnicities, genders, and cultural backgrounds. They serve as role models for the diverse students we seek to engage. PNNL's STEM Ambassadors share their passion for discovery and engage students, teachers, and the public in the wonders of science. Their enthusiasm for sharing science allows the Office of STEM Education to authentically connect PNNL's research with our local STEM education ecosystem as we partner with schools, nonprofit organizations, and other community organizations.

***"I really enjoyed having a PNNL
STEM Ambassador present to
our students. She was engaging,
energetic, and her presentation
on marine renewable energy was
geared appropriately for a high
school audience. I would love
to have her back in my class
in the future."***

Kim

Chiawana High School Science Teacher

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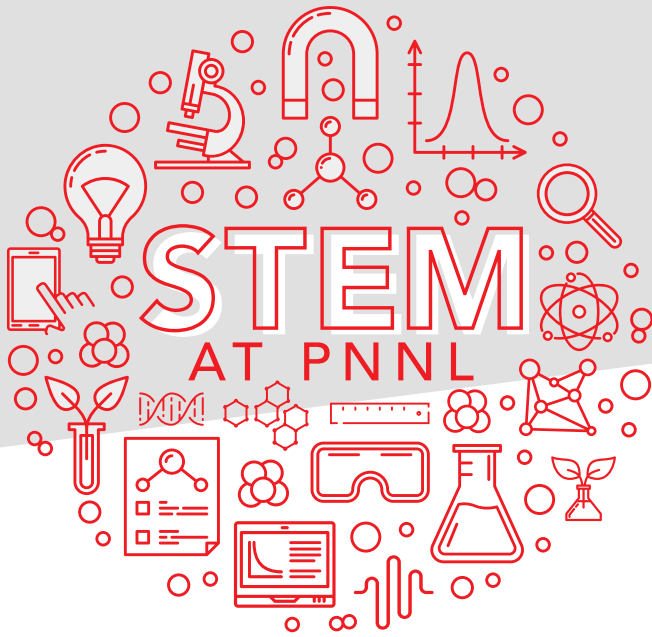
This effort aligns with the U.S. Department of Energy's efforts to support and sustain a national pipeline of highly skilled and diverse science, technology, engineering, and mathematics (STEM) workers.



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or email:
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STEM Ambassadors

“Being part of the STEM Ambassadors program has been a very rewarding experience. For years, I’ve been working independently or in small groups on outreach activities but this program has allowed me to find other PNNL researchers who are passionate about sharing what they do with the community. The investment in providing professional development training to PNNL staff to improve our ability to communicate and hands-on displays shows me that sharing our science with the community is a priority to lab leadership.”

Alison Colotelo
Project Manager, Ecology Group (EED)



PNNL’s Office of STEM Education offers ways to authentically connect PNNL’s research to support our local STEM education ecosystem and inspire a diverse future workforce through the STEM Ambassadors program. This professional development program, designed for researchers, channels your enthusiasm for science and helps you communicate your passion with the general public.

The STEM Ambassadors program dives into how people learn, how to communicate to a non-scientific audience, how to be a role model, and how to instill in others an interest in learning science. Through a partnership with the Pacific Science Center in Seattle, WA, we are a Portal-to-the-Public (POP) site which allows us the advantage of tapping into their vast resources.

STEM Ambassadors represent all three PNNL campuses in Richland, Seattle, and Sequim. Our STEM Ambassadors are diverse role models in ethnicity, gender, age, and research interests. Staff who engage in the program work in teams to develop interactive, hands-on displays that engage others in learning about the complex work of PNNL naturally and understandably. These displays are valuable when sharing research across different audiences, including technical sponsors, and government representatives who visit the Laboratory.

To learn more about the STEM Ambassadors program and how to engage with the Office of STEM Education, watch the video short:

<https://www.youtube.com/watch?v=zecCZPvpilI>

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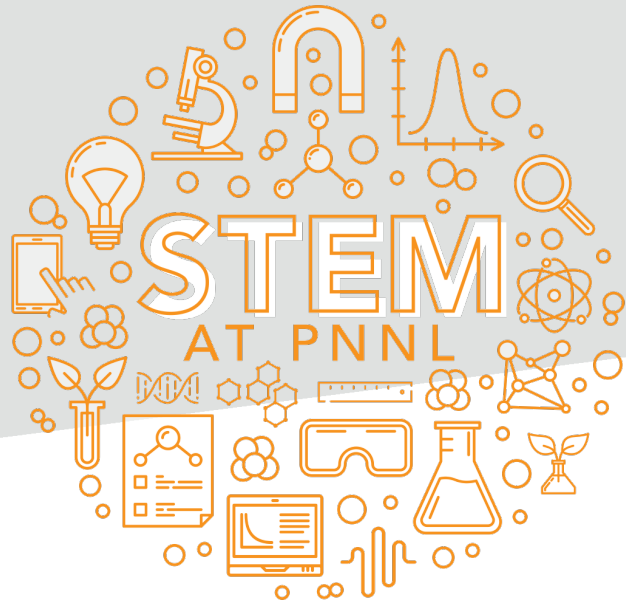
This effort aligns in support of DOE and the nation to sustain a pipeline of highly skilled and diverse **science, technology, engineering, and mathematics** (STEM) workers.



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STEM Equity and Inclusion

“Being a part of the MESA program, I learned how to become a strong, independent, hardworking person. Without the program, I would not have been able to receive the opportunities I did.”

**2018 Chiawana High School
MESA Student**

Washington State University Civil Engineering Major

At PNNL, we are committed to solving the world’s most challenging problems and answering its most elusive questions. Diversity and inclusion of people and thought is part of our unique social fabric, and a key to our success. In our science, technology, engineering, and mathematics (STEM) education and outreach efforts, we foster diversity to meet the demand for STEM skills and contribute to a diverse workforce of the future. Early and equitable STEM opportunities and experiences are vital in generating diversity in the workforce by motivating students of all genders, ethnicities, and socioeconomic status to pursue a STEM career.

In all PNNL Office of STEM Education programs, we seek to inspire and support students who are historically underrepresented in STEM fields. One of our signature programs is the Yakima Valley/Tri-Cities (YVTC) MESA (Mathematics, Engineering, and Science Achievement) program. It is one of six centers across Washington State whose mission is to empower underrepresented students by providing a community that supports their pathways to successful STEM careers. Our goal is to establish STEM pathways aligned with the diversity, equity, and education priorities of PNNL and the U.S. Department of Energy.

With expertise of PNNL science and engineering staff as well as close collaborations with educators, industry/community partners, and higher education institutions, we can inspire, prepare, and transform STEM education in Washington state and beyond.

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or email:

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MESA Math
Engineering
Science
@ Achievement

Yakima Valley/Tri-Cities



Who We Are

We are one of six MESA centers across Washington State led by Pacific Northwest National Laboratory whose goal is to increase the number of underrepresented and underserved students of color, females, and students from rural communities pursuing post-secondary education and entering the workforce in STEM fields.

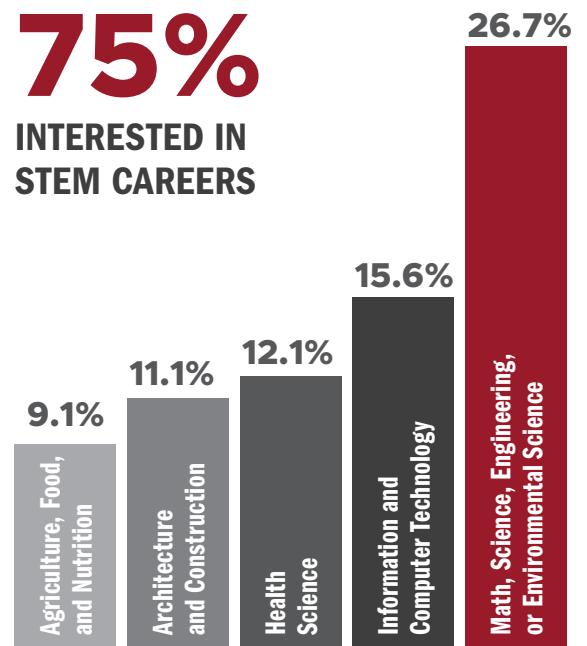
What We Do

Our program provides enriching, hands-on opportunities in mathematics, engineering and science to inspire, prepare, and increase exposure and interest in STEM and STEM careers for both our students and educators.

Why We Do It

We want to enable all our students opportunity and success for a STEM-focused future.

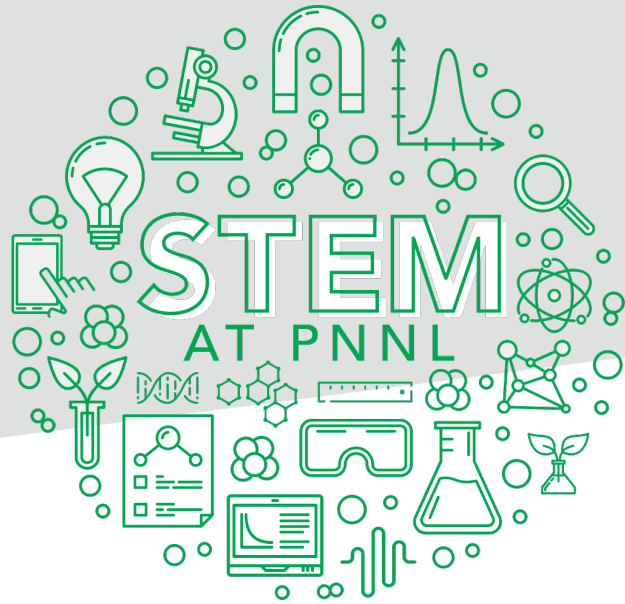
By working together, educators, school districts, parents, and community, we will create a program center that best meets the needs of our students and transforms STEM education in our local area.



In 2017-18, most of our YVTC MESA students are interested in STEM careers



According to Washington STEM, 67% of family-sustaining jobs in our state will be STEM-related by 2030.



Professional Development for Educators

“It is genuinely rewarding to know that as a scientist, I am potentially helping educate future generations of scientists by either increasing an educator’s comfort level with science or by spreading my enthusiasm for science on to the students. In turn, the eagerness of the teachers and students buoys my spirits and I am able to bring that increased level of engagement back into the workplace.”

Shannon Goodwin
PNNL National Security Specialist

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This effort aligns with the U.S. Department of Energy’s efforts to support and sustain a national pipeline of highly skilled and diverse science, technology, engineering, and mathematics (STEM) workers.

PNNL researchers represent science, technology, engineering, and mathematics (STEM) professionals who have chosen careers that will benefit our nation and the world. Sharing a researcher’s in-depth knowledge and passion with classroom teachers enhances a teacher’s understanding of STEM careers and bolsters the science they teach in the classroom. At PNNL, we believe these experiences can influence the career paths of students and positively affect the future STEM workforce.

PNNL’s STEM education specialists connect teachers with researchers, and design professional development experiences that are aligned with Washington State Science and Learning Standards. They are genuine immersion experiences that have proven to be a highly potent form of professional development for all participants. Opportunities range from one to nine weeks in the field, in the lab, or online. Special efforts are made to recruit participants (teachers) who can amplify efforts within diverse and rural communities.

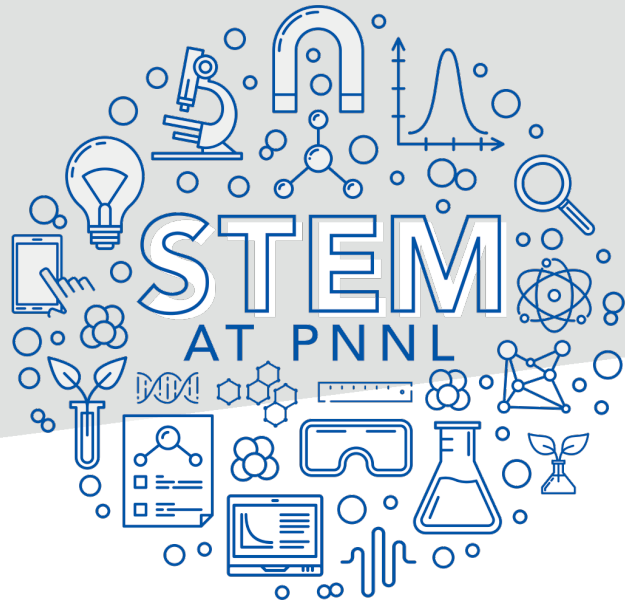
Fostering teacher-researcher connections helps us meet a shared goal— to inspire and educate the next generation of diverse STEM professionals.



For more information, visit:
www.pnnl.gov/stem



or email:
stem.education@pnnl.gov



Computing Science Education

Global demand for skilled workers in computing and cybersecurity fields is growing rapidly. Securing cyber infrastructure, protecting national security through data analytics, and improving the efficiency of our energy infrastructure are just three examples of how PNNL's computing capabilities are leveraged. With scores of skilled professionals working in computing and cybersecurity, PNNL is uniquely positioned to inspire and prepare students for careers in these domains.

PNNL's Office of STEM Education has piloted various efforts to expand and improve access to quality computing science education for all students K-20. Successful pilots have been expanded into a multi-faceted effort that includes career-focused learning experiences for students and content workshops and professional development for educators. Efforts also include leveraging PNNL's university partnerships to increase the opportunities for, and caliber of, computing education in local, state, and regional institutions.

PNNL's Virtual Reality for Computer Science program has expanded to highlight use of virtual reality and mobile apps, providing teachers with new ways to integrate meaningful computer science education strategies and technologies into their classrooms. These firsthand experiences increase opportunities for all students to gain knowledge and skills in computing.

"I cannot thank you and the rest of the instructors enough for the course. It was a real eye-opening experience and really has me thinking and motivated to make CS a bigger part of early education (pre-college). I was able to look for and find ways to integrate the problem-solving processes and think about using logic and the basics of computer science in everyday activities. I truly cannot thank you enough for the opportunity!"

Veronica Kenny
High School STEM Teacher

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SPACE SYSTEMS COMMAND

CHIRP

CYBER HALO INNOVATION RESEARCH PROGRAM

Education and Experience for the Cybersecurity Roles of the Future



The Space Systems Command (SSC) Cyber Halo Innovation Research Program (**CHIRP**) was established as a partnership between colleges, universities, and industry to drive innovation and create a diverse pipeline of talent in cybersecurity to fill positions at SSC and beyond.

CHIRP is a collaboration between California State University San Bernadino (CSUSB), Pacific Northwest National Laboratory (PNNL), and Space Systems Command (SSC) that offers students a two-year college to career program opportunity.



**THE WORLD IS CHANGING.
ARE YOU READY?**

As a CHIRP participant, you will:

- participate in cybersecurity internships at SSC, PNNL, or other industry partners
- complete a one-week professional development experience at PNNL
- receive a stipend from CSUSB
- be eligible for tuition reimbursement¹

Guidelines and Eligibility

Interested students who are studying cybersecurity or a related field may apply to the CHIRP program in the spring of their sophomore year. Accepted students will begin the program during the summer before their junior year and will commit to a full two years of participation. To meet and maintain eligibility, you must:

- maintain a 3.0 GPA in your major
- meet each semester with the CHIRP program manager or with your assigned advisor
- participate in career, curriculum, and experience pathways and required CHIRP events, including the bootcamp, research experiences, and a summer internship

Areas of Focus

As part of CHIRP, you will:

- work on cybersecurity-related research and development problems using tools and methods that are directly applicable to SSC
- gain skills and techniques that are directly applicable to protecting our nation's space-borne assets
- build your network of contacts at SSC, PNNL, and in the space industry

Your participation and training will open pathways for you in information technology, computer science, intelligence (national security), network security, cyber analysis, incident response, cyber policy, data architecture, continuity of operations, data analytics, machine learning, artificial intelligence, secure software development, and other cybersecurity-related fields.

Application Details

To apply to participate in the CHIRP program, you will need to complete the following. Guidance is available from the program manager to help you move through the process.

1

Complete the CHIRP application

2

Submit an essay that highlights your personal and professional goals

3

Submit your transcripts as evidence of academic progress (with GPA)

4

Solicit, collect, and submit two letters of recommendation

5

Complete an interview

Contact Information

For more information or to indicate your interest in CHIRP, please contact:

Vincent Nestler, Ph. D.

Associate Professor | Director, Cybersecurity Center | Principal Investigator, NICE Challenge Project

California State University, San Bernardino
VNestler@csusb.edu | (909) 537-5117

¹Upon graduation from the program, those who accepted tuition reimbursement during the program commit to work at SSC or PNNL equal to the number of years their tuition was funded through the program.

Headline: Serious Fun—PNNL VR App Wins International Award

Subhead: Network Collapse recognized for educational excellence in STEM

Body Copy: [Network Collapse](#), a virtual reality (VR) science, technology, engineering, and mathematics (STEM) app developed by Pacific Northwest National Laboratory (PNNL) researchers, has won a Gold award from the 2019 International Serious Play Awards.

The award-winning app, born of a collaboration between PNNL's Office of STEM Education and National Security Directorate's (NSD's) Visual Analytics group, is an experiential game that instructs users (i.e., K-12 students) about concepts included in the Computer Science Teachers Association K-12 Computer Science Standards.

Using VR to explain the web

Through six progressively difficult levels, Network Collapse models how information transmitted over internet networks is first broken down into smaller pieces, or packets, and is then shuffled through several devices before being put back together at its destination. The app also illustrates how malware and other viruses can impact sensitive data, how security measures protect information, and how network features such as routers, switches, and topology are interrelated.

Serious Play Conference takes Network Collapse seriously

The annual [Serious Play Conference](#), now in its 8th year, is a gathering of professionals invested in a future where games are and will revolutionize learning. Conference speakers from around the world discuss experiences and offer suggestions about developing the role of game-based programs in educational settings, including corporate, classroom, medical, government, and military curricula.

The conference internationally honors exceptional games used in educational and training environments.

VR and the next generation of STEM professionals

With its focus on computational science literacy and education, Network Collapse is well-suited to help further PNNL's goal of fostering STEM interest and learning. Its design can also help facilitate an all-inclusive STEM culture by opening learning doors for students in rural and/or underserved areas.

PNNL staff are already actively promoting the benefits of Network Collapse. Development team members Ann Wright-Mockler (STEM Education), Russ Burtner (NSD), and Cameron Tynes (NSD) demoed their creation at the STEM Showcase on May 28 in Sequim, Washington. The event amplified the PNNL STEM resources and technologies available to students, teachers, and school district staff; the goal is to provide this rural community with tools to help inspire and prepare students to pursue STEM careers.

Outside organizations have recently expressed interest in partnering with PNNL over Network Collapse.

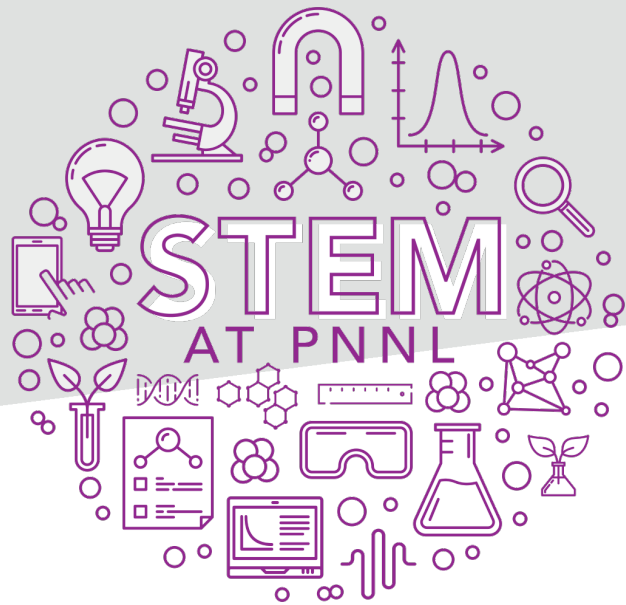
The Network Collapse development and project team also includes NSD's Nick Cramer, Dan Sanner, David McKinnon, Penny McKenzie, Sierra Maple (intern), and STEM Education's Evangelina Shreeve and Jennifer Knotts.

The game has been optimized for the Oculus Go, a new VR headset that is affordable for use in schools.

Network Collapse will soon be live on the Oculus Go app store.



Network Collapse development team members (L to R) Cameron Tynes, Russ Burtner, and Ann Wright-Mockler demoed the VR app at the STEM Showcase on May 28 in Sequim, Washington.



STEM Workforce Development

“Interns, students, and postdocs alike vie for the PNNL experience. It’s a memorable experience that not only serves to build the future STEM workforce, but also increases the number, diversity, and quality of STEM professionals who establish careers at national laboratories or engage as future collaborators.”

Paula Linnen

PNNL Executive Director of External Affairs

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To secure our nation’s future prosperity and security, the national lab system plays a critical role in helping prepare the future, diverse science, technology, engineering, and mathematics (STEM) workforce. PNNL offers comprehensive internship and workforce development programs for students in high school, undergraduate, or graduate programs. These programs and internships help inspire, grow, and retain students who are pursuing STEM studies and career pathways.

For more than 50 years, PNNL has served as a hub for innovation and research while connecting students, teachers, and educational partners in the K–20 system to real-world science experiences. The PNNL Office of STEM Education provides leadership in delivering equitable, engaging STEM learning and workforce development opportunities for diverse students and educators. Annually, we host more than 1,200 interns and research associates. PNNL’s Gold Experience internship program connects high school through graduate school students to immersive experiences in a variety of scientific disciplines. These internships expand their technical, communication, and cultural skills and grow their professional networks.

PNNL’s educational training programs attract a diverse population of students, allowing us to grow STEM talent and career pathways for traditional and underserved populations in Washington state and beyond. In turn, these students advance PNNL’s science and mission.



For more information, visit:

www.pnnl.gov/stem



or email:

stem.education@pnnl.gov

PNNL'S GOLD EXPERIENCE FOR INTERNS

FY 2021 RECAP

What It Is

PNNL's Gold Experience is an enhanced model and method for delivering an internship experience that embraces and demonstrates the Lab's core values of collaboration, courage, integrity, and creativity. The **PNNL Gold Experience** leverages new online engagement strategies, platforms, and tools to remotely deploy training, networking, and professional development events for PNNL's interns.

How It's Different

When on-campus internships are impossible, PNNL's Gold Experience assures that interns will still find a fulfilling, well-rounded experience to build their STEM interest and acumen and connect them with PNNL. Activities include comprehensive remote onboarding, online enrichment activities, virtual symposia and lab tours, monthly e-newsletters, mentor training and support, and frequent two-way communication.

1536

Students & RAs hosted in FY21
(+ 40% from FY20)



914

LTEs onboarded remotely

90%

PLEASED

with the hiring process

99%

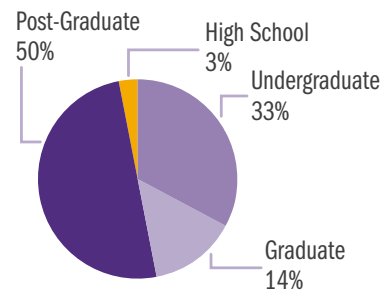
SATISFIED

with their PNNL mentor

96%

FURTHERING

STEM education



97%

Had an overall positive experience



99%

Would recommend a PNNL internship to others



Why It Works

Through the **PNNL Gold Experience**, our mentors feel supported and confident they can deliver a meaningful internship experience. Our interns better understand PNNL and DOE national laboratories, expand their soft skills, and are inspired to progress in their pursuit of a STEM career—with 78% interested in future remote internships!

THE PNNL GOLD EXPERIENCE

Networking & Collaboration

83 Networking Opportunities Offered

- New Hire Meet & Greet
- Tuesday With Events
- Monthly Mingle
- Virtual Game Event
- Coffee Break
- (NEW) QIS Coffee Break

Professional Development

102 Professional Development Opportunities Offered

- Virtual Tours
- LinkedIn Workshop/Working Group
- Virtual R Class
- Presentation Skills Workshop
- (NEW) Impactful Abstracts Workshop
- Power of Active Listening
- EndNote Workshop
- (NEW) QIS Learning Series

Mentor and Intern Resources

Intern Newsletter Stats

- 33 Issues Sent
- 4 Special Editions
- Average Open Rate: 64.5%

Mentor Newsletter Stats

- 12 Issues Sent
- Average Open Rate: 68.7%

“My mentor was a great mentor. He was patient when I made mistakes or needed time to work through things. He provided constructive feedback and encouraged progress throughout my internship. He also seemed enthusiastic about the work being done, which was encouraging. I would highly recommend him as a mentor for future interns”

2021 PNNL GOLD EXPERIENCE INTERN

“I really enjoyed PNNL’s intern program in many aspects, specifically the organization of Launchpad intern events and the culminating symposium at the end. In terms of my work, I thought it was really rewarding that I was creating deliverables for a sponsor and writing a report that would be referenced in the future as well as contributing to a cybersecurity AI/ML task”

2021 PNNL GOLD EXPERIENCE INTERN

VIRTUAL RESEARCH SYMPOSIUM

5

VIRTUAL RESEARCH SYMPOSIA HOSTED

43.8

HOURS OF RESEARCH PRESENTED

715

ATTENDEES

219

PRESENTERS

“My GEM Fellow was a fantastic intern, if given the opportunity to host a GEM intern again I will jump at that opportunity. She was both personable and adaptable on top of having a high technical aptitude”

2021 PNNL MENTOR

