2015-2016
Nevada Space Grant
Funded Faculty Projects

ABOUT NEVADA SPACE GRANT FACULTY PROGRAMS

Curriculum Development
The primary focus for the Curriculum Development program is to establish new and/or revised courses and materials that infuse NASA-related content within NSHE institutional curricula.

Hands on Training
The primary focus of the HOT program is to firmly establish new STEM hands-on-training activities that utilize NASA related interdisciplinary content within higher education curricula.

Informal Education
These funds are specifically targeted to stimulate STEM experiences for learning outside of formal classroom environments.

Pre College
The primary focus of this program is to train teachers and infuse NASA-related content into K-12 schools.

2015-2016 AWARDEES

Curriculum Development
Jason Steffen, University of Nevada, Las Vegas
How Your World Works: The Physics of Daily Life

Hands on Training
Dan Ruby, University of Nevada, Reno
AACT Alternate Powered Vehicle Program

Informal Education
Meghan Collins, Desert Research Institute
Paul McFarlane, Challenger Learning Center of Northern Nevada
Econauts and Habitat Earth: DRI Earth Science for CLCNN NASA Programming today and into the future

David James, University of Nevada, Las Vegas
Extending STEM education in informal settings through hands-on activities for K-6 and middle school

Pre College
Dan Ruby, University of Nevada, Reno
Pathways to Space Teacher In-Service Program

CURRICULUM DEVELOPMENT

Dr. Jason Steffen

How Your World Works: The Physics of Daily Life

Abstract

This program is to develop a conceptual physics course covering the variety of physics and astronomy principles that exist within and are essential for modern life. This course will ultimately be available in both a classroom and an online setting. The current curriculum in the Department of Physics and Astronomy does not have a conceptual physics course that covers basic principles for a non-science major. At the same time, many of the existing materials and texts for such a course lack relevance to today's students. The proposed course "How Your World Works: The Physics of Daily Life" (Physics 115) would fill both of the need for an introductory course in physics within the department and the need for material that is relevant to the modern, and highly diverse students at UNLV and the broader system of higher education in Nevada. The proposed class is interdisciplinary in nature, covering a wide range of STEM topics. Specific units or lessons within the course, which have particular relevance to NASA missions and data, are devoted to aeronautics and space flight, general relativity and cosmology, the Sun, Earth (and it's atmosphere), and the Moon, as well as topics on the use of formulas, the gathering and analysis of data, and the interpretation of graphs and figures.

Bio

Jason Steffen is an assistant professor in the Department of Physics and Astronomy at UNLV. He received his Ph.D. in physics from the University of Washington and was recently a Lindheimer Fellow at Northwestern University and the Brinson Postdoctoral Fellow at Fermilab. His primary field of research is in the field of exoplanets. He has been a member of the science team for NASA's Kepler mission for the last eight years, co-chairing the multibody working group.

http://www.physics.unlv.edu/~jsteffen/

HANDS ON TRAINING

Dan Ruby
AACT Alternate Powered Vehicle Program

Abstract

The AACT APV program is a robust project-based-learning experience that integrates with the existing STEM curriculum at the Academy of Arts, Careers, and Technology (AACT) high school of the Washoe County School District (WCSD). The program will continue to encompass design and fabrication of a vehicle for NASA's annual Human Exploration Rover Challenge by a student team, and this proposal seeks to expand to design and fabrication of a vehicle for the 2016 World Human Powered Speed Competition in Battle Mountain, NV and participation in the regional .American Society of Mechanical Engineers (ASME) Human-Powered Vehicle (HPV) competition alongside undergraduate Mechanical Engineering students from the University of Nevada, Reno (UNR). The existing program includes both undergraduate and graduate education students from UNR who receive college and professional development credits for participation in a primary advisory role, as well an experiential model for hands-on learning-by-design for new pre-college teachers at AACT. An added component would be PD in Fall 2016 toward building partnerships with similar Career and Technical Education (CTE) academies statewide through existing mechanisms (DRI Green Power program and NV Regional Professional Development Program (RPDP).

Containing both a formal classroom component and an informal extracurricular component, the program accomplishes hands-on training goals for high school students in many courses across academies at AACT: Engineering & Renewable Energy, Communication Arts & Media, Business & Finance, and Medical Careers through a two-year cycle, building up to 21 college credits through the TMCC Tech Prep and Engineering programs. For participating college students, the program gains independent study credits at TMCC, in engineering and applied technology, and at UNR through undergraduate and graduate credits through the College of Education (CoE). For in-service educators, the program earns state inservice credits toward license renewal.

As a formal WCSD curricular activity, the program necessarily adheres to Common Core state standards and Next-Generation Science Standards (NGSS). The two-year project cycle

consists of students in grades 9/10 working on systems design in year one; and advanced manufacturing, competition, and service learning (capstone projects and internships) for students in grades 11/12 in year two. Activities are centered at the shared AACT/TMCC Applied Technologies facility and advised by joint AACT/TMCC faculty. Industry partners are committed to advanced manufacturing internships for students. Fleischmann Planetarium serves as the coordinating organization and a site for public exhibits based on the project.

Bio

Dan Ruby is the director of Fleischmann Planetarium at the University of Nevada, Reno. With a primary job of public education and K-12 outreach on astronomy and space science, he engages 10,000 students per year into STEM through the lens of space. As a director for the Raggio Research Center for STEM Education, his research focuses on the effectiveness of formal/informal collaborations through hands-on student competitions: academics run as interscholastic athletics. Current work as the Reno team lead for the NSF-funded RECON project includes data collection on Trans-Neptunian Objects (TNOs) through occultations as part of a network of observatories from Mexico to Canada. From 2012 to 2013 he was active in the NASA SOFIA Airborne Astronomy Ambassador program, paired with a classroom teacher to create curriculum around remote sensing through participation in infrared astronomy research. In 2008-2010 he has served as cartography lead for the NASA-funded Earth-Mars Cave Detection Program, which combined thermal and visual-spectrum imaging to develop cave detection methods for Earth, Mars, the Moon, and beyond; his interest in caves comes from an understanding that caves serve as habitats and geologic and climatic records. When not spacing out, he volunteers as an educator mechanic for the Reno Bike Project, a non-profit dedicated to getting more people on more bikes more often.

http://planetarium.unr.edu/

INFORMAL EDUCATION

Meghan Collins and Paul McFarlane

Econauts and Habitat Earth: DRI Earth Science for CLCNN NASA Programming today and into the future

Abstract

In the EcoNauts and Habitat Earth program, Desert Research Institute (DRI) scientists and the Challenger Learning Center of Northern Nevada (CLCNN) will team up to deliver NASA-simulated Earth Science programming for 420 middle school students directly participating for the duration of the funding. Beyond the duration of the funding, with the capacity enabled by DRI scientists for the EcoNauts and Habitat Earth program, CLCNN will be able to serve over 1,260 students the next school year, increasing each year into the future.

Bios

Meghan Collins, Staff Research Scientist & Environmental Education Lead, DRI

Meghan Collins' academic and professional experience in the Earth sciences has spanned ecological science fieldwork, policy and research. Her undergraduate and Master's degrees are in environmental science, emphasizing international development and environmental policy. She has taught environmental science as an adjunct faculty member in community colleges in both the US and New Zealand. Collins now holds a position as Environmental Education Lead at the Desert Research Institute.

http://greenpower.dri.edu/

Paul McFarlane, Lead Flight Director, Challenger Learning Center of Northern Nevada

Herz Gold Medal Winner and Best of Education Recipient from the Reno Gazette-Journal, McFarlane was selected as Outstanding Student Teacher at UNR and as the Senior Scholar for the College of Arts and Sciences. He's taught K-College students for 24 years, created interdisciplinary STEM programs and worked as a writer and director of video projects. He's trained at the Kennedy Space Center, Johnson Space Center and the US Space and Rocket Center and has represented Nevada at Honeywell Educators@Space Academy. He's been in charge of developing and running Challenger Center space science programs for Nevada for the last eight years.

http://www.nevadachallenger.org/

INFORMAL EDUCATION

Dr. David James

Extending STEM education in informal settings through hands-on activities for K-6 and middle school

Abstract

The purpose of this project is to develop, test and deploy portable educational kits that teach principles of land surveying and geomatics (X marks the spot), aerodynamics (rubber band slingshot rocket, NASA touchdown), physics (Zip Line) and computer science fundamentals (Computer Science unplugged curriculum) to elementary and middle school students. We will also construct in quantity and expand the deployment of rubber band car and puff mobile. Several activities have previously been developed for classroom and informal settings (NASA touchdown based on PBS Design Squad, funded by the Public Broadcasting System and the National Science Foundation). The new activities are primarily intended for field/outside activities, including X marks the spot and Computer Science unplugged. The proposed activities are intended to support STEM learning efforts at science fairs, summer science programs, and in scout troops and Boys and Girls clubs.

Bio

David E. James earned a B.A. in Chemistry from UC Davis in 1975. He worked for Raychem Corporation in product and process development from 1975-1982. He earned his PhD in Environmental Engineering Science from the California Institute of Technology in 1989. He has been employed at UNLV since 1990, where he is currently Associate Professor and Director of Solar and Renewable Energy Programs at the University of Nevada Las Vegas (UNLV). Dave's research interests are in dust emissions and control, solar distillation, water quality, and in development of high-impact, cost-effective STEM experiences for primary grades. Dave has previously served as a Future City mentor to the Alexander Dawson School (2008-2013). He is available to serve as a STEM mentor and can bring STEM activity bucket kits to K-6 classrooms, after school clubs, scout troops and Boys n Girls clubs.

http://www.nspenv.org/stem.html

PRE COLLEGE

Dan Ruby

Pathways to Space Teacher In-Service Class

Abstract

Pathway to Space is a professional-development program for science and STEM teachers served by the Northwestern Nevada Regional Professional Development Program; this comprises Washoe, Storey, Lyon, Carson City, and Douglas counties. Participants will conduct hands-on activities, including high-altitude ballooning and rocketry, to address Earth and Space Science and Engineering Design concepts introduced in the Nevada Academic Content Standards for Science (NVACSS 2014, based on the national Next Generation Science Standards [NGSS]). The project will have an overarching theme of exploring the "path to space:" our atmosphere as the road to orbit and beyond, what it is made of, how we study it, and how we we explore space beyond with robots and humans.The project will provide new grade-banded kits developed during the 2015 Pathways to Space in-service course for powered flight (3-5), high-altitude balloons (6-8), instrumented rockets (9-10), and will expand this year to include UAV (11-12). It will provide three in-service credits for a total of 45 hours across 15 weekly sessions during the Spring 2016 semester and another three in-service credits for a second cohort during the Fall 2016 semester.

Bio

Dan Ruby is the director of Fleischmann Planetarium at the University of Nevada, Reno. With a primary job of public education and K-12 outreach on astronomy and space science, he engages 10,000 students per year into STEM through the lens of space. As a director for the Raggio Research Center for STEM Education, his research focuses on the effectiveness of formal/informal collaborations through hands-on student competitions: academics run as interscholastic athletics. Current work as the Reno team lead for the NSF-funded RECON project includes data collection on Trans-Neptunian Objects (TNOs) through occultations as part of a network of observatories from Mexico to Canada. From 2012 to 2013 he was active in the NASA SOFIA Airborne Astronomy Ambassador program, paired with a classroom teacher to create curriculum around remote sensing through participation in infrared astronomy research. In 2008-2010 he has served as cartography lead for the NASA-funded Earth-Mars Cave Detection Program, which combined thermal and visual-spectrum imaging to develop cave detection methods for Earth, Mars, the Moon, and beyond; his interest in caves comes from an understanding that caves serve as habitats and geologic and climatic records. When not spacing out, he volunteers as an educator mechanic for the Reno Bike Project, a non-profit dedicated to getting more people on more bikes more often.

http://planetarium.unr.edu/