On August 21, 2017, the NASA STEM EPDC offices at Texas State University were buzzing with activity in anticipation of a STEM education event: Solar Eclipse day! Millions across the country looked into the sky to see for themselves this incredible wonder. Thousands of educators and students were excited and motivated to see the phenomenon they had been learning about through the many webinars, lesson plans and hands on workshops delivered by the NASA STEM EPDC Specialists across the U.S.

There may not be an eclipse every day, but the technological innovations and unique educational resources offered by NASA motivate and inform educators and students every day! In year 3, NASA STEM EPDC conducted more than 600 professional development events serving more than 30,000 educators, assisting them in earning close to 14,000 learning badges through NASA STEM EPDC Digital Badging.

Looking to the future, it is critical to be clear about the importance of educator professional development. NASA and MUREP (the Minority University Research and Education Partnership) hold a distinguished role in helping schools and educators to prepare a STEM workforce with representation from the diverse populations found in our public schools. The STEM workforce pipeline does not originate in colleges and universities; early in their K-12 experiences, students develop academic interests and skills that will lead them into their fields of study in college and ultimately into career selections. Schools and teachers are the best avenue through which to provide opportunities to all students, especially those who are economically disadvantaged and from groups that have historically been under-represented in STEM.

NASA has made a substantial investment in the development of high-quality classroom resources, yet without a continuing, deliberate focus on educator professional development, many educators will be unaware of these resources, and resources will be under-utilized. Because of its unique assets and resources, NASA is in a prime position to introduce educators, and in turn students, to the importance of space exploration. Through utilizing NASA’s unique assets and resources, combined with a commitment to educator professional development, the U.S. will achieve the vibrant and highly-diverse STEM workforce needed to be on the leading edge of scientific innovation and space exploration.

The LBJ Institute for STEM Education and Research at Texas State University and the NASA STEM EPDC are honored to be a part of this crucial work, and it is with great enthusiasm that we launch into the fourth year of this critically important mission.

Araceli Martinez Ortiz
NASA STEM EPDC, Principal Investigator and Executive Director

Leslie Huling
NASA STEM EPDC, Program Director
By utilizing NASA’s missions and unique assets, we are developing educators who will prepare a robust and creative cohort of future STEM professionals to lead the way in solving scientific and engineering challenges not yet envisioned.
AN INVESTMENT THAT MAKES A DIFFERENCE

NASA STEM EPDC

Through the use of NASA-unique assets, NASA STEM EPDC’s (Educator Professional Development Collaborative) commitment is to conduct research and to equip educators with enhanced knowledge and resources to provide high-quality, engaging STEM PD to all students, with a special emphasis on those groups who have historically been under-represented in STEM fields.

The NASA STEM EPDC is generating a powerful return on investment for NASA by:

**IMPACTING**
We are making an impact on STEM instruction nationwide through engaging, standards-aligned professional development.

**INNOVATING**
We enrich educator learning experiences by providing access to NASA-unique assets and innovative technologies.

**RESEARCHING**
We contribute to the preparation of the next generation of scientists and engineers and research the impact NASA’s Education investment.

**PARTNERING**
We are creating powerful NASA partnerships with university and community stakeholders.
We are making an impact on STEM instruction nationwide through engaging, standards-aligned professional development.

Developing Educators Wherever They Are

High quality professional development is a necessary ingredient in preparing educators to guide their students through rigorous and engaging STEM learning opportunities that will inspire students and propel them toward future STEM careers. In this way, educators and the professional development they receive, fulfill a critical role in broadening the STEM pipeline that in turn will enable the U.S. to continue to lead the world in scientific innovation and space exploration.

In addition to high-quality face-to-face professional development, NASA STEM EPDC also provides educators with synchronous and asynchronous NASA professional development offerings utilizing NASA-unique assets.

NASA STEM EPDC provides the flexibility busy educators need to tailor their professional learning. We offer a comprehensive program of NASA content for educators, including webinars and longer duration professional development through a collaboration of course offerings through U.S. Satellite offered for graduate credit.

Pre-Service Teachers
Pre-service teachers—or students in educator prep programs—strengthen their content knowledge in STEM and build their portfolio of skills and resources when they become involved with the NASA STEM EPDC program. This builds their confidence to create a more impactful STEM education experience in their future classrooms.

Informal Educators
In addition to traditional educators, other professionals in our society fulfill an educational role in providing learners with important learning opportunities. The informal educator who works in community organizations, after school and summer programs, or museums are examples of such professionals that NASA STEM EPDC is committed to serving.

In-Service Teachers
The responsibility to inspire students to pursue careers in STEM fields largely depends on the guidance of the K-12 teacher. The NASA STEM EPDC program aims to guide these in-service teachers toward a wealth of resources to enhance their teaching of STEM subjects and sound culturally responsive teaching approaches.

University Faculty
The preparation of K-12 STEM teachers seems to yield the greatest benefit when collaborating with faculty from departments of Science, Technology, Engineering, Mathematics, and Teacher Education. The dedication and work of these faculty is critical to encourage and nurture the young minds of the workforce of tomorrow.
NASA STEM EPDC has a commitment to provide tailored professional learning for educators at every phase of their careers, as well as for those educators who prepare and support the continued professional development of educators.
ETOUCHES & REPORTING

Etouches is our event registration system that streamlines registration and certification processes. We collect a wide range of data for reporting purposes and monitoring impact and national reach of NASA STEM EPDC services.

Etouches provides:

» Easy event registration and tracking
» Participant surveys
» Completion certificates for CE credit
» A wide variety of reports detailing participant breakdown and statistics
» Record-keeping of individual participation across subjects

DIGITAL BADGING PLATFORM DEVELOPED BY PENN STATE

NASA STEM EPDC also operates the Digital Badging System that is hosted by Pennsylvania State. The NASA STEM EPDC Digital Badging System allows educators to earn badges as part of their ongoing personal professional development in many STEM content areas aligned to NASA Missions. The badges can be converted into CEUs for certified teachers, allowing educators to receive recognition from their employers and state teacher licensure boards.

Additional Technologies:

<table>
<thead>
<tr>
<th>FY OCT 2016- SEPT 2017</th>
<th>SINCE FEB 2016 LAUNCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,303 Badges</td>
<td>1,893 Badges</td>
</tr>
<tr>
<td>10,688 Hours of PD Credits</td>
<td>15,385 Hours of PD Credits</td>
</tr>
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</table>
Face-to-Face PD
Face-to-face professional development events are classified as on-site or off-site depending upon whether they were conducted at one of the 10 NASA Centers (on-site) or in some other location (off-site). While fewer in number, on-site events tend to be longer in which teachers actively engage with NASA personnel and NASA classroom resources.

Online PD
Webinars are conducted by NASA STEM EPDC specialists and Texas State and partner faculty content experts on a variety of subjects. These events take place online, in one of 12 digital Adobe Connect classrooms hosting up to 100 participants, with one hosting up to 500.

The events are publicized on the website and through NASA Express, a weekly communication that is disseminated to more than 20,000 subscribers and is available to approximately 11 million NASA Twitter followers.

NASA STEM EPDC Website and Blog
(www.txstate-epdc.net)
Educator professional development offerings are continually updated and featured on the NASA STEM EPDC website where educators can register online using the eTouches platform. Additionally, blogs are posted regularly that share various STEM teaching strategies and NASA resources. In addition to the NASA STEM EPDC specialists, blog submissions are received from faculty at the NASA STEM EPDC MSI partner institutions and leadership team, ensuring a continuous flow of new content on the website.

PROFESSIONAL DEVELOPMENT EXPERIENCES

Diana Garcia
Bilingual Elementary Teacher
San Marcos, TX

The transformative nature of the NASA STEM EPDC program has inspired Diana Garcia to steward change on her campus.

“We’ve learned about the importance of being culturally responsive to our students. It is really important because when you’re trying to teach them something abstract and if there is no connection there with the child, no relationship, then the child may not be motivated and you’re just wasting your time.

It’s really urgent for us to go back and be advocates and share these resources with other teachers. We need to be teaching our children how to be critical thinkers, how to be thinking like engineers. If we don’t teach our kids that way of thinking then we are doing a huge disservice, especially since so many Hispanic children and especially girls are not represented in these careers so we need to advocate for these resources. I hope that I can be a good advocate for this on my campus.”
Leveraging NASA Resources

NASA STEM EPDC has a strong commitment to introducing educators to NASA unique resources and innovative assets that are only available at NASA centers, such as space launch and engine testing facilities and astronaut training centers. In addition, we provide access to NASA classroom lessons, activities, and resources that educators can utilize with students, including existing NASA Education resources and access to service capabilities at the NASA centers nationwide.

NASA CENTERS

NASA STEM EPDC is uniquely positioned to provide educators with opportunities to complete professional development through engaging with subject matter experts and education specialists at each of the ten NASA Centers.

Each NASA Center, which focuses upon a range of topics, research, and activities based on the facility and personnel capabilities, can offer different professional development experiences.

For example, utilizing projects and tools on the subject of launching rockets and teaching about robotics along with examples, connections, and resources developed by NASA engineers provide educators with content that will create a meaningful experience for students beyond a textbook.

By teaching educators how to use NASA images and data collected by NASA scientists, students will be able to explore real world problems and examples—directly related to NASA activities in real time.

NASA STEM EPDC Specialists

By housing a NASA STEM EPDC specialist at each center, it enhances the ability of NASA STEM EPDC to provide real examples from NASA centers on topics including space exploration, aeronautics research, and other mission directorates.

At each of the ten NASA Centers, there is a NASA STEM EPDC specialist assigned who is specifically qualified to leverage that center’s unique expertise and facilities in educational professional development materials and experiences.

Located at Texas State University, two additional specialists provide nationwide support in areas of culturally responsive teaching, instructional strategies for English language learners (ELL), and impact research in STEM education. These 12 specialists hold faculty of practice positions in Texas State University’s College of Education.
By fostering involvement, engagement, and awareness of NASA unique content through professional development to educators, NASA STEM EPDC positively influences the education of children across the United States.
Dr. Barbara Buckner  
Armstrong Flight Research Center

Ms. Susan Labarre-Kohler  
Glenn Research Center

Dr. Brandon Rodriguez  
Jet Propulsion Laboratory

Ms. Sara Torres  
Nationwide CRT & ELL support

Dr. Dr. Karen Roark  
Ames Research Center

Dr. Deepika Sangam  
Goddard Space Flight Center

Mr. John Weis  
Marshall Space Flight Center

Mr. Steven Smith  
Johnson Space Center

Dr. Lester Morales  
Kennedy Space Center

Mr. Stephen Culivan  
Stennis Space Center

Dr. Anne Weiss  
Langley Research Center

Dr. Samuel Garcia Jr.  
Nationwide NASA Impact Research
Cathy Ann Campbell attended a NASA professional development at Kennedy Space Center (KSC) in the summer of 2017.

“By working with this program, I learned that there were so many free NASA resources for both students and educators. Aside from the amount of phenomenal resources that we received, I really appreciated being at a NASA Center and having the education specialists there to show us how to do the activities. It is wonderful that I am able to use these fun, cross-curricular concepts and incorporate so much NASA science into the classroom for my students. This opportunity has been so inspiring and enriching for me. I really, really, really hope it just never goes away and is here to stay.”
A Nationwide Impact: Years 1–3

The 12 NASA STEM EPDC Education Specialists delivered 1,381 educational events across the United States directly reaching more than 65,000 formal and informal educators. These events included educators from all 50 states, the District of Columbia, Puerto Rico, and the US Virgin Islands. Through the MSI Teacher Educator Network and the Emerging Stars Network, EPDC also has a partnership with more than 100 universities from 34 different states, the District of Columbia, Puerto Rico, and the US Virgin Islands.

Number of Educators Served by NASA STEM EPDC

<table>
<thead>
<tr>
<th>Year, FY</th>
<th>Number</th>
</tr>
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<tbody>
<tr>
<td>2015</td>
<td>11,630</td>
</tr>
<tr>
<td>2016</td>
<td>34,209</td>
</tr>
<tr>
<td>2017</td>
<td>65,309</td>
</tr>
</tbody>
</table>
In the first three years, NASA STEM EPDC reached more than 111,000 educators nationwide.
**Researching Educational Impacts**

The NASA STEM EPDC program has implemented a comprehensive evaluation model that will help determine which educators are receiving NASA professional development services through what specific delivery mechanisms, as well as the topics, frequency and duration of the professional development in which they are engaging.

These evaluation and research efforts will provide NASA with important insights on how best to expend resources in educator professional development to result in the desired impacts.

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**According to a Harvard study by Chetty, Friedman, and Rockhoff,* students with effective teachers achieve about three times the academic gains than those with less effective teachers, regardless of their backgrounds.**

Since NASA STEM EPDC serves tens of thousands of educators each year, we are poised to conduct research and learn even more about how NASA educational initiatives impact educators and students.
NASA STEM EPDC
Research efforts:

OBJECTIVES
The educator STEM PD offered by NASA STEM EPDC is designed to meet NASA’s Strategic Goal 6:

*Share NASA with the public, educators, and students to provide opportunities to participate in our Mission, foster innovation, and contribute to a strong national economy.*

To this end, NASA STEM EPDC impact, evaluation, and research initiatives seek to understand the effectiveness of its professional development program in increasing educators’ STEM knowledge and skills, and its impact on educator’s instructional practices.

WHAT’S BEING STUDIED?
We will continue studying and assessing the impact of NASA STEM EPDC events upon participants’:

- knowledge and skills
- instructional practices
- attitudes and beliefs
- awareness and usage of NASA resources

HOW IS THIS ACCOMPLISHED?

- developing and validating new research instruments
- collecting research data from 100,000 participants in the next 3 years
- collecting detailed impressions from the voice of educators about their needs through focus groups
- comparing differences of impact between short, moderate, and long duration PD
**Evaluating Professional Development Experiences**

To understand the effectiveness of our efforts, a research framework is used to study features of high quality teacher professional development. These four factors are critical in positively impacting teachers’ self-reported increases in knowledge, skills and classroom practices.

**CONTENT**
How can STEM content topics be best presented to educators to keep them up-to-date with application and career connections?

**DURATION & MODE OF DELIVERY**
What length of professional development and type of learning events prove to be most effective?

**COHERENCE**
How can educators leverage NASA educator resources in such a way that they are able to align these to their State learning standards?

**COLLECTIVE PARTICIPATION**
What is the impact of professional learning communities in STEM? What elements of on-line learning in STEM PD are most effective?

If NASA wants to contribute towards the preparation of academically strong STEM students and potential NASA workforce participants, NASA must invest in supporting teachers to be effective in the areas of science, technology, engineering and mathematics.

Dr. Anderson is faculty research partner of NASA STEM EPDC. His research interests include studying urban education and the interrelationships of STEM curriculum, student engagement, and student discipline.

“As a school administrator in urban areas, I instantly recognized the benefit of the NASA learning activities and design projects that engage students in hands-on learning to solve real-world problems. NASA is helping to bring rich science content to students who otherwise wouldn’t necessarily have access to these opportunities. Educators with diverse experiences must receive continuous PD in key areas and be encouraged to remain involved- because we know our children of color.

I’ve also found that education policies might be based on research, but reflect a lack of cultural understanding. In my work at the university, we directly impact teachers, and over a short period of time, we will work with 100 teacher candidates, ultimately impacting 100,000 students.”
Building Networks

Utilizing NASA resources, NASA STEM EPDC’s professional development offerings provide educators of diverse students with specific instructional strategies and enhancements that capture the imagination of students of all backgrounds and help them connect with the content in meaningful ways that relate to their lives and personal experiences.

Given the diversity of the U.S. student population, this ambitious endeavor requires the expertise of educators from different STEM fields working in tandem with teacher educators, researchers and scholars who specialize in the science of learning and culturally responsive instructional practices.

A number of intertwined networks have been created that bring educators from different disciplines together to work collectively on the design and delivery of culturally responsive STEM instruction using NASA resources.

The MSI Teacher Educator Network

Minority Serving Institutions (MSIs) from across the U.S. are not only essential partners in the preparation of the next generation of STEM teachers, but faculty in these institutions have a wealth of expertise to share about working with diverse learners and the integration of culturally relevant instructional strategies that promote the STEM success of all students.

The MSI Teacher Educator Network (MSI TEN) is comprised of STEM faculty members from Texas State University and fifteen partner universities that provide specialized expertise in the field of culturally responsive teaching in STEM. The MSI TEN faculty identify NASA curriculum activities that can be strengthened and develop new content for diverse student populations. They also revise undergraduate and graduate courses to include additional NASA resources and to emphasize culturally-responsive teaching.

The Emerging Stars Network

These MSI institutions are committed to enriching their STEM teacher preparation programs and value professional development in STEM education for their faculty. NASA STEM EPDC specialists at the NASA Centers frequently provide online and face-to-face professional development for the Emerging Stars institutions. Ninety-Two NASA MSI Emerging Stars Network Member Institutions have joined since 2015.
In order to have a robust and creative STEM workforce, it is necessary for students from all backgrounds to be provided with high quality STEM experiences that build upon the students’ strengths as a foundation for future academic and career success.
NASA STEM EPDC & MSI TEN:

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Mr. Edgar Gomez
Ms. Angela Behnke
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University of South Florida
Dr. Eugenia Vomvordi-Ivanovic
Adriane Tailfeathers
Pre-service Teacher
Salish Kootenai College
Pablo, MT

MSI TEN Partner Institutions

Adriane participated in a 2017 summer teacher institute. She contributed to the group learning about the importance of culturally responsive teaching in STEM subjects.

“For me, this experience was completely life changing, especially because I’m coming from a small Indian reservation. I never in a million years thought I would be at NASA Ames! And so here I am, a Blackfeet woman, from a small community in Montana, you know, seeing these amazing things that NASA does—when I get back, now I can help that small community as a teacher.

I was fortunate to have the Blackfeet way of life, so that’s like always been a part of me. It’s like walking in two different worlds.”
Leadership Team

LBJ INSTITUTE FOR STEM EDUCATION AND RESEARCH COLLEGE OF EDUCATION
DIRECTORS

Dr. Araceli Martinez Ortiz
Texas State University Principal Investigator and NASA STEM EPDC Executive Director

Dr. Leslie Huling
NASA STEM EPDC Director

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Dr. Jennifer Jensen
Department of Geography

Dr. Kathryn Lee
College of Education

Dr. M. Alejandra Sorto
Department of Mathematics

Dr. Vedaraman Sriraman
Department of Engineering Technology

OTHER PARTNERS AND CO-INVESTIGATORS

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Deans, Texas State University

Dr. Keith Duclos
DC&M

Dr. Roy Clariana
Pennsylvania State University’s Center for Online Innovation in Learning (COIL)

Karen Woodruff and the late Glen Schuster
Program Directors, U.S. Satellite, Inc.
SUMMARY OF PROFESSIONAL DEVELOPMENT EVENTS

THE NASA STEM EPDC BADGING SYSTEM AWARDED

- 1,303 digital badges
- 10,688 hours of PD credit

IN FY 2017, NASA STEM EPDC UTILIZED

- 12 SPECIALISTS
- Around the country to service
- *educators have participated in PD experiences ranging from 1-60 hours

65,309 EDUCATORS*

- 2,726 Pre-Service
- 10,542 Elem.
- 12,639 MS
- 7,813 HS
- 3,412 Higher Ed
- 1,136 Admin
- 3,186 Informal
- 23,855 Other

TWO THOUSAND SEVENTEEN
Fiscal Year 2017: October 2016 to September 2017

- 623 EVENTS
- 219 Online Webinars
- 245 On-Site Face-to-Face Events
- 159 Off-Site Face-to-Face Events

15 MSI TEN PARTNERS
92 EMERGING STARS PARTNERS
10 NASA CENTERS
About Us
The NASA STEM EPDC program is a professional learning initiative resulting from a five year (2014–2019) cooperative agreement between NASA’s Minority University Research and Education Project (MUREP) and Texas State University’s LBJ Institute for STEM Education and Research.

LBJ Institute for STEM Education and Research
Headquartered in San Marcos, Texas at Texas State University, The LBJ Institute for STEM Education and Research, under the leadership of the College of Education and the LBJ Institute for STEM Education & Research, coordinates the NASA STEM EPDC program and other grant-funded activities. The College of Education is the largest university producer of teachers in Texas, and the second largest nationally, preparing 800 to 1,000 teachers each year.

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Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.


Photo is of the Mars Global View of Valles Marineris. Composed of over 100 Viking Orbiter images, this is a mosaic of the Valles Marineris hemisphere of Mars. Photo courtesy of NASA/JPL-Caltech.