A report of STEM engagement and educator professional development activities carried out by NASA STEM EPDC from October 1, 2018 - September 30, 2019.
Using NASA-unique assets, NASA STEM EPDC is committed to conducting educational research and providing high-quality STEM professional development to educators. Armed with these enhanced skills and repertoire of resources educators can better engage and teach their students. Our efforts collectively support the goals of NASA, the Minority University Research and Education Project (MUREP), and the Office of STEM Engagement.

Message from the Directors:

PREPARING THE STEM WORKFORCE & BROADENING PARTICIPATION
Leveraging NASA's missions, technological breakthroughs, and scientific understanding.

The NASA STEM Engagement and Educator Professional Development Collaborative (EPDC) is firmly part of the NASA family. We share a mission, contribute in a strategic manner, and have highly qualified educators who support NASA's work by providing educator professional development and engaging students in STEM learning. Our contributions relate to the MUREP mission and these three major NASA Office of STEM Engagement goals:

» Creating unique opportunities for students/public to contribute to NASA's work in exploration and discovery: We raise awareness and prepare university faculty and their students, particularly those at minority serving institutions, to take advantage of unique NASA opportunities. We have created new digital resources and seek the contribution of students at conferences that target historically underrepresented groups in STEM.

» Building a diverse future STEM workforce: We engage students in authentic learning experiences with NASA people, content, and facilities to assist in building a diverse future STEM workforce.

» Strengthening public understanding of NASA's work by enabling powerful connections: We utilize powerful digital online resources, promote culturally responsive instructional approaches, and link to various learning communities to help strengthen public understanding of NASA's mission and work.

The following pages present a summary of our year five work and its impact and invite the reader to enjoy highlights of some of our proudest moments.
NASA STEM EPDC directly contributes to the advancement of NASA's Strategic Goal #3: Address National Challenges and Capitalize Economic Growth, Objective 3.3 Inspire and Engage the Public in Aeronautics, Space and Science. This strategy is expanded by:

**Enabling the public to embrace and understand NASA’s work and value**, today and tomorrow, by providing unique STEM opportunities for diverse stakeholders.

**Contributing to our nation's science literacy** through educator professional development designed to promote improved STEM education.

**Elevating the public’s understanding and appreciation** of the value of STEM and the many career opportunities in STEM fields.

**EPDC SUPPORTS NASA GOALS**

Office of STEM Engagement Update
October 2019
NASA STEM EPDC Badging System

A “badge” is a micro-credential or certification in a specific topic area. In support of professional development for educators and STEM engagement for students, the badging system offers a personalized, relevant, and engaging experience.

The robust, quality system designed for STEM educators and students tracks learning, provides access to online courses, and maintains a certification database. Evidence of progress in skill attainment is monitored while the completion of related activities, assessments, and projects are documented.

THE FACTS

- LAUNCHED IN FEBRUARY 2016
- 40+ EDUCATOR BADGES
- STUDENT BADGES WILL BE LAUNCHED IN YEAR SIX
- NEW BADGES DEVELOPED AND PUBLISHED ON A REGULAR BASIS
- ASSESSMENT MODULE INTEGRATED FOR ALL BADGES
- BADGES ARE ALIGNED TO NGSS AND CC

BADGES BY THE NUMBERS

EARNED SINCE FEB 2016 LAUNCH

3,403 digital badges

25,312 hours of PD credit

NASA STEM EPDC VIRTUAL EDUCATION RESOURCES

Virtual Learning Community

WEBSITE
- Blogs & EPDC Resources
- EPDC Event Registration
- Educator News & Opportunities
- Links to NASA.gov Educator Resources

Online STEM - Synchronous Learning

WEBINARS
- Online instruction on NASA STEM topics
- Special learning events for educators
- Introductory sessions prior to live events
- Special interest group collaborations

Micro-Credentialing - Asynchronous Learnings

BADGES
- Physical/ Life/ Earth & Space Science
- Engineering & Technology
- Mathematics
- STEM Instructional Practices
- NASA Strategic Themes

Global Registration & Evaluation System

DATA MANAGEMENT
- Registration database for all events
- Automated event feedback mechanism
- Extended surveys for detailed insight regarding impact of NASA STEM EPDC
### BADGING MANAGEMENT PROCESS

#### Design

- Utilize standards-based curriculum development approach to create a quality learning experience
- Connect the STEM content to relevant and current NASA context

#### Pilot/Review

- Internal teams of badge specialists conduct quality reviews of draft badges
- Collect user data on pilot launch of new badges
- Make appropriate adjustments
- Assign ongoing badge evaluators

#### Launch Badge

- Announce badge launch to special interest groups
- Monitor badge completion
- Report to stakeholders
- Communicate with learners as needed

#### Evaluate

- Evaluate badge evidence as it is submitted
- Issue badge completion/ certificates
- Recommend related badges
- Reporting

### THE BADGES

#### NASA PHYSICAL SCIENCE

<table>
<thead>
<tr>
<th>Design</th>
<th>NASA Rockets: Forces &amp; Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy &amp; Power for Living on the Moon</td>
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<tr>
<td>Pilot/Review</td>
<td>Rocketry In/Out of the Classroom</td>
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<td>NASA Does Matter</td>
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#### NASA ENGINEERING & TECHNOLOGY

<table>
<thead>
<tr>
<th>Design</th>
<th>Engineering Design Process</th>
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<tbody>
<tr>
<td></td>
<td>NASA Spinoff</td>
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<tr>
<td>Pilot/Review</td>
<td>On the Moon: Engineering 6–12</td>
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<tr>
<td></td>
<td>Space Operations Learning Center (K–6)</td>
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#### NASA LIFE SCIENCE

<table>
<thead>
<tr>
<th>Design</th>
<th>Radiation &amp; Human Health</th>
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<tbody>
<tr>
<td></td>
<td>Moon Munchies</td>
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<tr>
<td>Pilot/Review</td>
<td>Red Planet/ Green Thumb</td>
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<td></td>
<td>Looking for Life</td>
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#### NASA STRATEGIC THEMES

<table>
<thead>
<tr>
<th>Design</th>
<th>Journey to Mars: NASA LaRC 100 Educator</th>
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<tr>
<td></td>
<td>Aeronautics: NASA LaRC 100</td>
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<tr>
<td>Pilot/Review</td>
<td>Earth Right Now Langley 100th</td>
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#### NASA EARTH & SPACE

<table>
<thead>
<tr>
<th>Design</th>
<th>Blue Marble Matches: Earth Processes</th>
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<tbody>
<tr>
<td></td>
<td>Curved Space-Time in the Classroom</td>
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<td>Earth’s Orbit &amp; Distance from the Sun</td>
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#### STEM INSTRUCTIONAL PRACTICES

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<tr>
<th>Design</th>
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<td>Variables: Independent, Dependent, &amp; Controlled</td>
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<td>Ways of Knowing &amp; Student Inquiry</td>
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<tr>
<th>Design</th>
<th>Year of the Solar System Math (6–12)</th>
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**IMPACTING**

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

**Developing Educators & Their Students**

High-quality professional development is a key ingredient in preparing educators to guide their students through rigorous and engaging STEM learning opportunities that will inspire and propel them toward future STEM careers.

In this way, NASA STEM EPDC fulfills a critical role in broadening the STEM pipeline that will, in turn, enable the U.S. to continue to lead the world in scientific innovation and space exploration.

In addition to high-quality face-to-face and online professional development, NASA STEM EPDC also provides students with authentic STEM engagement experiences utilizing NASA-unique content and assets. This comprehensive program for educators includes workshops, webinars, digital badges, and face-to-face professional development.

Educator and student offerings are continually updated and featured on the NASA STEM EPDC website ([www.txstate-epdc.net](http://www.txstate-epdc.net)) where individuals may register for events that best meet their needs.
SCALABILITY TO MAGNIFY NASA’S REACH AND IMPACT

Tapping into NASA’s mission, we focus on student opportunities, the future STEM workforce, and public understanding, to create a program for learners everywhere— from elementary school to graduate students.

PROGRAM DRIVERS & REQUIREMENTS

» Evidence-based strategies
» Rigorous planning
» Integrated operation model

FOCUS AREAS

» Create unique opportunities for student contribution
» Build a diverse future STEM workforce with engaging, authentic learning experiences
» Strengthen public understanding by creating powerful connections to NASA’s mission and work

RESULTS

» Robust, strategic, and balanced STEM portfolio
» NASA-unique learning experiences
» Student contribution to NASA’s work

WHO WE SERVE

K-20 Students
Pre-Service Teachers
In-Service Teachers
Informal Educators
University Faculty
Building partnerships through relationships is at the heart of our work at NASA STEM EPDC.

It is also at the core of how we integrate cultural responsiveness and relevance in the services we provide. Through years of professional development, the relationships developed with educators and other stakeholders is now being leveraged to bring us deeper into communities of learning. In areas with the highest concentrations of historically disenfranchised people, participants can be wary of “outsiders.” Building strong partnerships with educators opens doors to allow us to bring our resources where they are most needed and have the greatest significant impact. Our partners give us insight into what the greatest needs may be in their community and help to guide us as we tailor our programs for those students.

I love “ah-ha moments” when you hear the collective gasp as students and educators grasp a concept and understand the connection.

Through monthly webinars and digital badging, NASA STEM EPDC is able to reach educators and students across our nation. By delivering presentations with cutting edge NASA videos and classroom activities we provide real-life connections to national standards, NASA missions and NASA-unique resources. One of our goals is to relate NASA’s unique content with the daily lives of the students while also respecting their culture and backgrounds.

Making an impact with STEM engagement will continue to keep this great nation at the forefront of technology, innovation, and advancement while also preparing our future workforce and inspiring the next generation of explorers.
Leveraging NASA Resources

NASA STEM EPDC has a strong commitment to introducing educators to NASA-unique resources and innovative assets that are available at NASA centers, such as:

» Space launch and engine testing facilities
» Astronaut training centers
» Access to NASA classroom lessons, activities, and resources that educators can utilize with students
» Existing STEM Engagement lesson plans and activities
» Access to service capabilities at the NASA centers nationwide

NASA STEM EPDC SPECIALISTS AT NASA CENTERS

Housing a NASA STEM EPDC specialist at NASA centers, NASA STEM EPDC is able to provide real examples from NASA centers on topics including space exploration and aeronautics research. Training educators to use NASA images, resources, and data collected by NASA scientists enables students and educators to explore real-world problems directly related to NASA activities.

2020 NASA STEM EPDC SPECIALISTS (Locations)

Ms. Michelle Berry
Texas State University

Dr. Barbara Buckner
Goddard Space Flight Center

Dr. Samuel Garcia Jr.
Kennedy Space Center

Ms. Kimberly Klein
Armstrong Flight Research Center/Ames Research Center

Ms. Susan Labarre-Kohler
Glenn Research Center

Dr. Deepika Sangam
Texas State University

Mr. Steven Smith
Johnson Space Center

Ms. Sara Torres
Ames Research Center/Armstrong Flight Research Center

Dr. Anne Weiss
Langley Research Center

Dr. Vemitra White
Marshall Space Flight Center/Stennis Space Center

(INNOVATING

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

(2018-2019 Specialists included Dr. Lester Morales, Mr. John Weis, and Mr. Steve Culivan)
We are creating powerful NASA partnerships with university and community stakeholders from different disciplines.

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. These products help educators connect with content in 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 a variety of STEM fields. STEM experts work in tandem with teacher educators, researchers, and scholars who specialize in the science of learning and culturally responsive instructional practices to create meaningful STEM engagement experiences. A number of intertwined networks have been cultivated that bring educators from different disciplines together.

MSI TEN

The Minority Serving Institutions Teacher Educator Network (MSI TEN) members are a combination of STEM faculty members from Texas State University and fifteen partner universities. MSI TEN faculty have a wealth of expertise to share about working with diverse learners and the integration of culturally relevant instructional strategies to promote the STEM success of all students.

EMERGING STARS

The more than 100 MSIs that comprise the Emerging Stars Network are committed to professional development for their colleagues and enriching their STEM teacher preparation programs. NASA STEM EPDC specialists at the NASA Centers frequently provide online and face-to-face professional development for the Emerging Stars Network institutions.
We live in a world in which data drive decision making and influence how resources are allocated.

It is critical to engage in research efforts that empirically and quantitatively measure the impact of public investments made in educational initiatives and programs. For the past 5 years, NASA STEM EPDC has been a key partner and contributor in advancing NASA’s STEM engagement mission and goals. The scale of NASA STEM EPDC’s contribution is considerable and merits scholarly inquiry and research to help paint a picture of the sizeable impact this work has had on educators, students, and communities. Organizing, analyzing, and sharing valuable data with the public will help other entities learn from successful practices, contribute to the overall STEM knowledge base, and help inform future policy and project decision-making.

NASA STEM EPDC is providing quality learning environments, no matter where students live.

There are many conceptual frameworks for integrating STEM in the classroom with the purpose of engaging learners and motivating more students to pursue STEM career pathways. As a NASA EPDC Education Specialist, the goal is not only to provide online access to NASA STEM educational resources but also to guide educators and students through the Project-Based inquiry strategies that incorporate engaging STEM challenges while working in collaborative teams. As the teams complete Project Based Learning lessons and incorporate the NASA resources, they are instilled with confidence to gather evidence to make decisions. NASA STEM EPDC is providing quality learning environments, no matter where students live, by extending our reach to areas that often do not have access to NASA STEM experiences. These skills will help students and educators understand and solve some of the challenges of today and tomorrow.
Researching Educational Impacts

The NASA STEM EPDC program has implemented a comprehensive evaluation model that identifies the specific delivery mechanisms through which individual educators receive NASA professional development services, as well as the topics, frequency, and duration. These evaluation and research efforts will provide NASA with important insights on how best to expend resources in educator professional development for optimal impact.

SECONDARY EDUCATORS REACHED BY NASA STEM EPDC

<table>
<thead>
<tr>
<th></th>
<th>Yr 1 FY 2015</th>
<th>Yr 2 FY 2016</th>
<th>Yr 3 FY 2017</th>
<th>Yr 4 FY 2018</th>
<th>Yr 5 FY 2019</th>
<th>Total Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle School</td>
<td>2,430</td>
<td>8,198</td>
<td>12,639</td>
<td>5,894</td>
<td>4,438</td>
<td>33,599</td>
</tr>
<tr>
<td>High School</td>
<td>1,140</td>
<td>4,367</td>
<td>7,813</td>
<td>4,672</td>
<td>3,686</td>
<td>21,678</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3,570</td>
<td>12,565</td>
<td>20,452</td>
<td>10,566</td>
<td>8,124</td>
<td>55,277</td>
</tr>
</tbody>
</table>

* NASA STEM EPDC impacted over 55,277 secondary teachers in five years. In ten years, these teachers could potentially impact more than 55 million students.
EDUCATIONAL RESEARCH FRAMEWORK

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 online learning in STEM are most effective?

OUR RESEARCH PROCESS

1. Develop and validate new research instruments
2. Collect research data from participants
3. Collect detailed impressions from the voice of educators about their needs through focus groups
4. Analyze data
5. Use data to guide and improve instruction and future deliverables

RESEARCHING

We contribute to the preparation of the next generation of scientists and engineers and research the impact of NASA’s investment.
LBJ INSTITUTE FOR STEM EDUCATION AND RESEARCH

Dr. Araceli Martinez Ortiz
Principal Investigator, NASA STEM EPDC
Executive Director, LBJ Institute for STEM Education and Research

Dr. Leslie Huling
Director, NASA STEM EPDC
Senior Advisor, LBJ Institute for STEM Education and Research

TEXAS STATE UNIVERSITY COLLABORATING FACULTY

Dr. Bahram Asiabanpour
Ingram School of Engineering

Dr. Kristina H. Collins
College of Education

Dr. Jennifer Jensen
Department of Geography

Dr. George Koutitas
Ingram School of Engineering

Dr. B.J. Spencer
Department of Engineering Technology

Dr. Vedaraman Sriraman
Department of Engineering Technology

TEXAS STATE UNIVERSITY SUPPORTING COLLEGES

Dr. Christine Hailey
Dean, College of Science and Engineering

Dr. Michael P. O’Malley
Dean, College of Education

NASA STEM EPDC TEAM

LBJ Institute for STEM Education and Research
Dr. John Beck
Ms. Angela Behnke
Ms. Jan Ellis
Ms. Karen Fabac
Mr. Edgar Gomez
Dr. Virginia Resta
Dr. Laura Rodriguez Amaya
Ms. Stacey Sanders
Ms. Monica H. Uribe

MSI TEN FACULTY

Alabama A&M University
Dr. Samantha Strachan

Bowie State University
Dr. Florence Etop

Coppin State University
Dr. Mintesinot Jiru

Lehman College, City University of New York
Dr. Gillian U. Bayne

Mississippi Valley State University
Dr. Candice Carter-Stevens

Morgan State University
Dr. Christian Anderson
Dr. M. Monique McMillian

Universidad Interamericana de Puerto Rico Arecibo
Dr. Victor M. Concepción-Santiago

University of Illinois at Chicago
Dr. Danny Bernard Martin

University of Maryland Eastern Shore
Dr. Patricia Goslee
Dr. Candice Ridlon
**YEAR 5**

**420 EVENTS**

- **131** Online Webinars
- **186** Off-Site Face-to-Face Events
- **103** On-Site Face-to-Face Events

**IN FY 2019, NASA STEM EPDC UTILIZED:**

- **10** SPECIALISTS around the country to serve
- **67,937** EDUCATORS*

  with the following break down:

  - **1,642** | Pre-Service
  - **4,784** | Elementary
  - **4,438** | Middle School
  - **3,686** | High School
  - **1,269** | Higher Education
  - **731** | Administration
  - **1,746** | Informal
  - **49,641** | Other

*Educators have participated in PD experiences ranging from 1-60 hours

- **27** DIGITAL BADGES
- **154** HRS OF PD CREDIT

**EMERGING STARS PARTNERS**

- **117**
## Educators Served

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<tr>
<td>Pre-Service</td>
<td>992</td>
<td>2,109</td>
<td>2,726</td>
<td>1,813</td>
<td>1,642</td>
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<tr>
<td>Elementary</td>
<td>2,047</td>
<td>6,653</td>
<td>10,542</td>
<td>6,283</td>
<td>4,784</td>
<td>30,309</td>
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<td>2,430</td>
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<tr>
<td>Higher Education</td>
<td>1,765</td>
<td>1,189</td>
<td>3,412</td>
<td>2,137</td>
<td>1,269</td>
<td>9,772</td>
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<tr>
<td>Administrator</td>
<td>101</td>
<td>535</td>
<td>1136</td>
<td>705</td>
<td>731</td>
<td>3,208</td>
</tr>
<tr>
<td>Informal Educators</td>
<td>982</td>
<td>1,638</td>
<td>3,186</td>
<td>2,490</td>
<td>1,746</td>
<td>10,042</td>
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<tr>
<td>Other</td>
<td>114,798</td>
<td>9,520</td>
<td>23,855</td>
<td>27,569</td>
<td>49,641</td>
<td>225,383</td>
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<td><strong>Totals</strong></td>
<td><strong>124,255</strong></td>
<td><strong>34,209</strong></td>
<td><strong>65,309</strong></td>
<td><strong>51,563</strong></td>
<td><strong>67,937</strong></td>
<td><strong>343,273</strong></td>
</tr>
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</table>
LOOKING AHEAD TO 2020

As we implement our broader scope of work in the next few years, we will carefully consider how to design educational approaches that are data driven, research-based, and sustainable. In addition to offering expanded digital resources we will increase our national scope to emphasize reaching educators and students in the five Mega-States—our nation’s largest, most diverse states (CA, FL, IL, NY, and TX). We have a strategically reorganized team with a great deal of experience and understanding of K-12, higher education, and informal education.
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.

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 College of Science and Engineering, and the LBJ Institute for STEM Education & Research, coordinates the NASA STEM EPDC program and other grant-funded activities.

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