TEXAS STATE
LBJ INSTITUTE FOR
STEM EDUCATION AND RESEARCH

STEM Research
White Paper Series

August 2018
Volume: 2
Number: 7

Nurturing Culturally Responsive STEM Educators: Assessing the Impact of NASA STEM EPDC Professional Developmenton Educator Pedagogical Beliefs and Practices

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August 2018

This Publication Should Be Cited As Follows: García Jr., S., & García-Torres, S. (2018). NASA STEM EPDC Long- Duration Professional Development Leads to Positive Changes in Educator Professional Practices (STEM Research White Paper Series, Vol. , No.). Texas State University: LBJ Institute for STEM Education and Research.

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About Future Aerospace-engineering and Mathematicians Academy (FAMA)

Future Aerospace-engineering and Mathematicians Academy better known as FAMA is part of a national effort funded by NASA's Minority University Research and Education Project (MUREP) designed to improve early awareness opportunities for children to learn about STEM careers and opportunities through preparation. The program specifically targets historically underserved and underrepresented students in STEM disciplines. For the past three years, FAMA has provided yearlong programing concentrated in San Marcos, Texas and has quickly become a valued resource in the community. FAMA includes four components. The components include Family Café, NASA Exploration Family Backpacks, Teacher Professional Development, and Summer Camps. The first component, Family Café focuses on supporting afterschool STEM activities for families and students. The second component, NASA Exploration Family Backpacks schools coordinate take-home STEM activities for students and their families in a culturally relevant way. The third component, The FAMA Aerospace Engineering Lab, a computer lab set up in a community center supports students and community members in technical needs. The teacher professional development prepares certified teachers for facilitating summer camps. The fourth component includes Engineering and Math Summer Camps. This article will focus on the content and delivery of the teacher professional development as well as the effects and impact on teaching practices of participants.

"It's only been a few days but it already feels like a community. The curriculum has lent itself for us to feel comfortable with each other in such a short time." – PD Participant

Professional Development Training

In preparation of the FAMA camp, NASA STEM EPDC hosted a day and half long workshop at the local cultural arts center, Centro Cultural Hispano de San Marcos. The curriculum for the workshop covered engaged STEM educators in a variety of individual and collective activities that explored STEM based topics, resources, and pedagogical approaches. The facilitation of the PD employed interactive, dialogical, and reflective methods that integrated technology and cross-curricular concepts. The educators actively participated in NASA based lessons designed to promote curiosity, problem solving and cooperative learning skills. The participants were also exposed to curriculum design, discipline based content, and instructional methods for enacting culturally responsive teaching in the STEM classroom.

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Method-Data & Analysis

The research design followed a systematic data collection process that employed various qualitative methods designed to capture the impact of NASA STEM EPDC professional development (PD) on teacher practice. Total participants included five elementary certified teachers and four middle school certified teachers. The demographics included three males and six females. The first phase of the PD consisted of a forty-minute classroom observation during which field notes were taken to help document and chronicle classroom instructional practices.

Classroom observations were informed by the Dimensions of Success (DoS) tool which primarily focused on facilitator instructional practices and degree of student engagement, responses, and participation. Operating within this framework provided a focused approach to data collection which actively sought to document instructional methods and resources utilized in the classroom. The observations were followed by a 10 minute debrief session during which field notes were exchanged, compared, and analyzed. This approach facilitated sensemaking processes and supported triangulation of collected data. One focus group, or *plática*, was conducted with both elementary and secondary teachers. *Plática* was selected as a method for data collection because it provided an organic, culturally responsive collective space for participants to engage in deep conversation and sharing of experiences, insights, and reflections. *Pláticas* were audio recorded and lasted about an hour and centered on instructional practices and resources covered during the PD session. The final phase of data collection was the administration of a questionnaire via Qualtrics. The instrument provided participants an additional opportunity to individually reflect and comment on their PD and classroom experiences.

Data Analysis

Interviews, field notes, and questionnaire data were collectively compiled and organized following a systematic process for sensemaking and interpretation. The framework for analysis was informed by Saldana's (2009) first and second coding techniques. This approach aided in the development of initial codes, which were further examined to create larger, overarching themes that emerged from the data.

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"Culturally Responsive Teaching for me means realizing that my background as a middle-class Anglo, isn't the lens that a lot of my students come from…I have to keep reminding myself that everybody has a rich perspective."-PD Participant

Key Selected Findings

This paper briefly highlights some of the emerging findings from the observations that indicate pedagogical, behavioral, and attitudinal changes related to culturally responsive teaching. The findings presented are participant responses that reveal broader thematic evidence of impacts attributed to NASA STEM EPDC professional development.

Developing and Deepening Cultural Awareness

Taken together, one of the most pertinent findings that emerged from our study was related to teachers' understanding of culturally responsive teaching, thoughts and beliefs, which were captured through classroom observations and reflective statements shared by the participants.

In one particular case, an elementary summer camp teacher responded patiently and humanely when a young student was disengaged. The teacher intervened and was able to redirect the student's behavior into an activity that reengaged student in a dignified way. A post interview, the teacher responded to the question: How confident do you feel in teaching in a culturally responsive way? "I think that it means relating to and responding to the different needs of the different students wherever they are coming from and where they are the being able to supplement or extend where they are." Her response to the question supports classroom practices utilized in a diverse learning environment and approaches taken to diffuse a potentially disruptive situation, which was captured and documented in field notes during our classroom observation.

During our group *plática*, another educator shared about how he intentionally helped enact culturally responsive learning experiences in the classroom. To create the conditions for learning, the teacher shared that, "We also used a video that highlighted the lack of girls in engineering to talk about representation in STEM and discuss real world solutions to address these issues." Discussing and applying real-life issues into the classroom setting is a key element of culturally responsive teaching that affords young people to actively examine the world they live in.

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Conclusion

Within a day and half long training session, and a week of practical classroom experience, teachers shared that exposure to material and classroom experiences impacted their awareness, understanding, and approach to culturally responsive teaching. Our observations further support the statements and experiences shared by the participants. Their participation in NASA STEM EPDC professional development stimulated reflection and thinking that moved participants to consider alternate methods and approaches to utilize in STEM learning settings. These emerging findings provide encouraging evidence that further validate and support the value of engaging teachers in high quality PD opportunities and experiences.

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This work was supported by NASA EPDC Collaborative agreement NNX14AQ30A

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This material is based upon work supported by NASA under grant or cooperative agreement award number NNX14AQ30A.