

STEM Planning and Building Capacity at HSIs: Lessons Learned From KickStarter

AHSIE Best Practices Institute

**Professional Development: Skills Building for the Successful
HSI Educator**

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March 10, 2020



**Science Foundation Arizona
Center for STEM**

Outline

- KickStarter Overview
- KickStarter Results
- Broader Impacts
- Success Stories
- Lessons Learned
- Q&A

KickStarter Overview



**Science Foundation Arizona
Center for STEM**

KickStarter Vision

Increase the quantity and quality of STEM students who utilize the Community College system as part of their pathway to achieve certificates, Associate's, Bachelor's and advanced degrees.



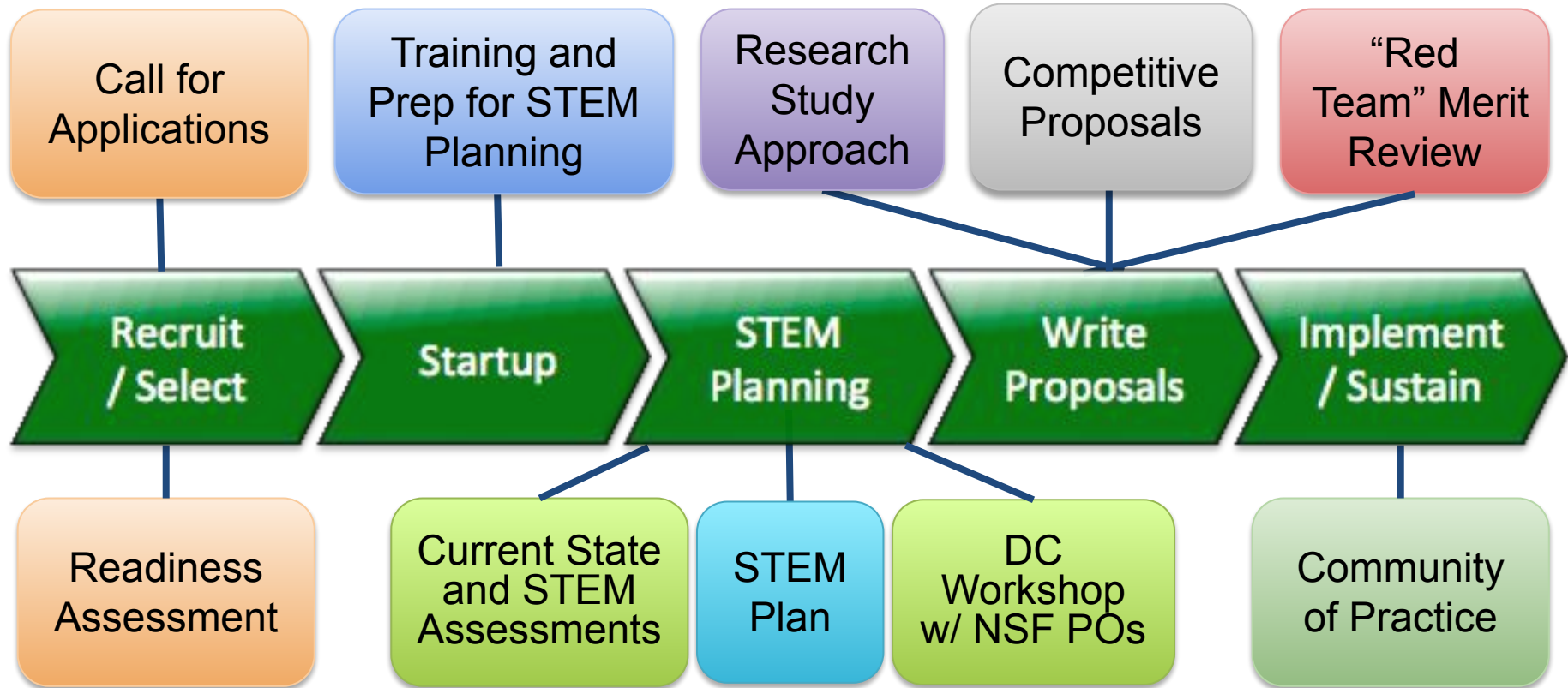
KickStarter Program

- Pilot program (NSF #1450661) and continuation (NSF #1929686) to learn from community college Hispanic Serving Institutions (2-year HSIs)
- Assist HSIs with strategic STEM planning, concept development, proposal preparation and submission. Not a grant writing program but a ‘teach them to fish’ approach to building capacity
- Originally sought to serve 12 HSIs in 5 states (CA, AZ, NM, TX, FL)

Goals and Impacts for KickStarter Participants

1. Improve HSI's STEM Pathway strategies and ability to provide evidence of effectiveness in future proposals (capacity to identify, collect, and analyze information)
2. Establish key partnerships that lead to more Hispanic students in the STEM pipeline
3. Develop a minimum of two proposals to NSF with one being funded
4. Develop and implement funded projects, conceive new projects, and find new partners to further expand their STEM-based initiatives

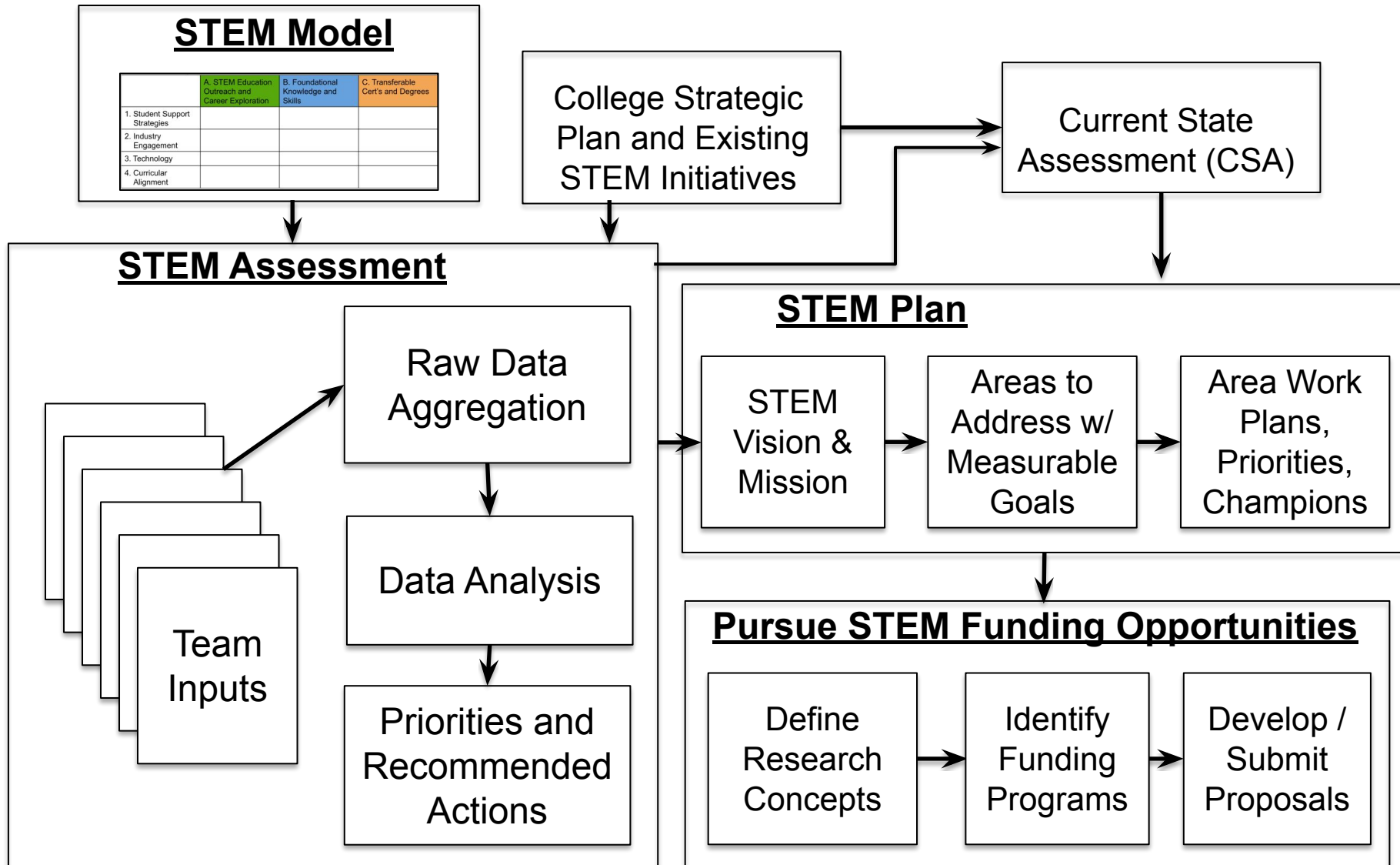
KickStarter Process



STEM Team

- ~10 Members
- Cross-disciplinary. Broad definition of STEM to include workforce/CTE and academic/transfer
- STEM Administrators, STEM Faculty, Student Support Specialists, Institutional Research, Grant Development
- Ideally Faculty from several disciplines
- Team composition can change as needed

SFAz STEM Assessment and Planning Framework



Heat Map Data Analysis

SCALE: 0=NONE, 1=MINIMAL, 2=ADEQUATE, 3=COMPREHENSIVE

SUMMARY OF ALL RESPONSES MAPPED TO HIGH LEVEL PATHWAYS MODEL COMPONENTS			
	A STEM Education Outreach and Career Exploration	B Foundational Knowledge and Skills	C Transferable Certifications and Degrees
1 Student Support Strategies	2.5	1.7	2.0
2 Industry Engagement	1.5	1.0	1.2
3 Technology Integration	1.7	2.7	1.2
4 Curricular Alignment	1.6	2.1	2.3

Priorities and Recommended Actions (excerpt)

Aggregated Team Inputs (automated)

Total	Pathways Recommendations	Strengths Summary	Improvements Summary	Recommended Actions
0.3	A2a: Designated staff person to coordinate industry relationships		create the position and hire someone, Assign to someone,	
0.3	C3b: Offer Virtual Field Trips of companies to students who cannot travel to off campus sites.		work with Toyota to develop a virtual field trip video,	
0.7	B2a: Collaborate with an established outside industry advisory board with which to connect and garner advice from local businesses/ industry.			
0.7	C2a: Collaborate with local industry to help students successfully prepare for their future.			
0.7	A3c: Collect data (i.e. demographics, # of participants, program evaluations, and teacher participation in events along a pathway) via technology for various outreach programs.			
1.0	B1a: Tutoring center or other areas of individualized student assistance for resources and support.		Need a dedicated center, Need a dedicated center,	

Meet to discuss, interpret, recommend

Current State Assessment (CSA) [Link to Template](#)

1. Summary of College Responses from Application to KickStarter: STEM Team, College Vision /Mission/ Strategy, Student Demographics, Existing STEM Efforts, Industry and Academic Partners
2. Heat Map from STEM Assessment
3. Strengths, Weaknesses, Opportunities, Threats (SWOT) Analysis
4. List of Priorities

STEM Plan Development

[Link to Template](#)

1. Create a STEM Strategic Overview Statement

Based on self awareness of where you are in STEM, write a high level strategic statement

2. Translate College Strategy and CSA (STEM Assessment Data, SWOT, and Priorities) to STEM Goals

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STEM PATHWAYS PLAN
College Name

Plan Overview

STEM Strategic Overview:
Based on self-awareness of where you are in STEM, the college's STEM strengths, and the college strategic plan, moving forward, where do you want to be?

STEM Pathways Goals: (desired outcomes connected to the STEM Strategic Overview, Heat Map Assessment and Synthesis of Recommended Actions, and tied to STEM Domains)
Provide 3-5 **broad** desired changes in programs, impact of programs, relationships etc. to be made

- 1.
- 2.
- 3.
- 4.

3. Create a Work Plan for each Goal

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STEM PATHWAYS PLAN
College Name

Work Plan
(A detailed plan of the objectives/targets, how they will be achieved, resources required, and how success will be measured, repeated for EACH Goal.)

Goal: (taken from plan overview):
1.

Objectives List specific measurable targets for each tactic or task that will be performed to achieve the larger overall goal.	Tactics/Tasks List the specific and measurable statements of what will be done to achieve each objective to meet the overall goal.	Resources Estimated people, equipment, facilities, and/or funds.	Estimated Timeline Starts in the next 6 months, 1 year out, 2 years out (6m, 1y, 2y).	Person Responsible Owner to carry this forward (required)
a.	•	•	•	•
b.	•	•	•	•
c.	•	•	•	•
d.	•	•	•	•

Desired Outcomes: (Measurable)
List and explain the specific measurable changes in programs, impact of programs to participants and broader community, relationships etc. that correspond to this goal.

- 1.

Research Study Approach (RSA) Phases

[RSA Template](#) and [other Resources](#)

1. Initial Concept Ideation

2. Literature Search/ Review of Prior Art

3. Research Question Development

4. Intellectual Merit Broader Impacts

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RSA PHASE 1: INITIAL CONCEPT IDEATION

Please summarize your initial concept so that we can start matching your ideas with program areas. This will help the SFAZ KickStarter team set a rough timeline for your RSA, 1-page concept form and ultimate proposal submission.

Date: _____ **Institution Name:** _____

Concept Lead #1 (Name, Email, Title):	Concept Lead #2 (Name, Email, Title)

Broad Areas of Interest (e.g., Math, Biology, Undergraduate Research, Advanced Technician Education, Transfer Programs, etc.): _____

Alignment to College Strategy or STEM Plan: _____

Problem Statement: Characterize the overarching problem the you want to solve, for whom, why it needs to change. 1-3 sentences.

Proposed Intervention or Desired Outcome: Describe the potential solution or desired outcome for the problem described above. This is a starting point to the ideas can be vague. The graduate director will help us to narrow down where the proposal fits into the general types of programs available. 1-3 sentences.

Hypotheses: (Capture testable predictions of what might occur as a result of solving your problem. Will you be able to decide whether a hypothesis is true or false using the information/data collected in your study?)

A. _____

B. _____

C. _____

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RSA PHASE 2: LITERATURE SEARCH TO EXAMINE PRIOR ART

(This serves as a launch point and can be expanded as you go through proposal writing for a particular grant. At a minimum go to the NSF Public Access Repository (<https://pubs.csl.dcu.edu/>) or <https://pubmed.ncbi.nlm.nih.gov/> and search for similar projects, topics, etc. based on keywords generated from your problem statement, proposed intervention, and hypotheses. If that still does not result to exactly what you need, capture the following information either in this document or using Zotero, a free, easy-to-use tool to help you collect, organize, cite, and share your research sources. <https://www.zotero.org/>)

Keywords	NSF Public Access Repository	Pubmed	Pubmed	NSF Public Access Repository	Pubmed	How did we locate it?	How our identified effort related to yours?

*** Continue a [References Cited Document](#) with NSF compliant references that map to short citation (can be done later during proposal writing if desired, but you may find it easier to construct as you go). Add a link your References Cited document to this RSA in the Literature Search section. Alternatively, download and use Zotero, a free, easy-to-use tool to help you collect, organize, cite, and share your research sources at <https://www.zotero.org/>. If you use Zotero, it will automatically generate the References Cited after you insert citations into a Microsoft word document.

*** Use as input to future proposal writing, when you cite this reference.

*** Use as input to the description for Intellectual Merit and Future proposal writing, when you cite this reference.

Supporting Rationale for Problem Statement: (Summarize findings from literature search supporting resolution of the problem at large before stating how the problem is readdressed for the college and including any supporting data the college may have already collected.)

Revise Summary of Proposed Intervention: (Revise proposed approach/interventions to solve the problem, based on findings from Literature Search, if applicable.)

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RSA PHASE 3: RESEARCH QUESTION DEVELOPMENT

Research Question List: (Reformat an initial list of questions that if answered would help address the problem and potentially lead to the desired outcomes.)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Evaluate Appropriateness of Research Questions: (Exercise the Research Question List above and use items 1 - 10 below to eliminate questions that do not meet the criteria. Capture notes in the Worksheet below.)

1. Does the question deal with a topic or issue that interests us enough to spark our unique thoughts and opinions and engage/serve our community and its interests?
2. Does it pass the "so what" test by filling a gap and/or leading to greater knowledge and significant impact if it is answered?
3. Who does it benefit and how? Significance, benefits, and interest of the Research to your Community, potential funders, others in the same or similar fields.
4. Considering the type and scope of the information that we need to gather, is the research question too broad or too narrow? (Use answers to items 6-10 as inputs to answering item 4)
5. Given the answers to items 1 - 4, do we have a good quality research question that we actually will be able to answer by going research?
6. What type of information will we need to answer the research question?
7. Is the scope of this information reasonable?
8. What sources will have the type of information that we need to answer the research question?
9. Do we currently collect any of this information?
10. Can we access the information sources in 8 and 9?

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RSA PHASE 4: INTELLECTUAL MERIT AND BROADER IMPACT

Intellectual Merit: (Refer to the notes from the literature search and columns 1 and 2 in the Worksheet. Create a short paragraph of two to three sentences about the evidence that your project impacts the intellectual field and why it matters. Does it broaden participation in STEM? Include considerations for disseminating the knowledge gained during the study to increase impact beyond the immediate participants in the study via publications and otherwise.)

Broader Impact: (Refer to the notes in column 3 of the Worksheet and create a short paragraph of two to three sentences about the evidence that your project impacts the intellectual field and why it matters. Does it broaden participation in STEM? Include considerations for disseminating the knowledge gained during the study to increase impact beyond the immediate participants in the study via publications and otherwise.)

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Declinations and Tools

- Start uploading on the last day and/or use Grants.gov
- Don't follow the detailed requirements for the solicitation → Use a checklist. Prepare 1-page summary and discuss with NSF Program Officer.
- Lack of a clear research question or educational research focus → Research Study Approach
- Lack of administrative support, a change in college strategic direction, no faculty engagement → Develop concept from STEM plan, with strategic foundation (CSA)
- Proposal not clear → Use Logic Model
- Good concept, but many small problems → Engage team early including IR, educational researcher and external evaluator

KickStarter Results



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KickStarter Results

Overall \$10.5 M in NSF grants awarded and 50% proposal success rate

	Submittals	Awards	Declines	Award Rate
Cohort 1	18	9	9	50%
Cohort 2*	14	4	7	36%
Cohort 3*	9	5	2	71%

*Some submittals are still under review so numbers do not add up.

KickStarter Results by NSF Program

	Submits	Awards	Declines	Award Rate
S-STEM	13	4	9	31%
ATE	10	6	2	75%
HSI	12	8	1	89%

Programs with proposals but no awards: IUSE, AISL, DRK12

Capabilities Developed

STEM Planning and Strategic Overview

- Cross-functional, cross-college STEM Team working together to develop a STEM plan
- Ability to identify and prioritize a menu of program concepts supporting a STEM plan

STEM Education Research Skills

- Strategic consideration of future research concepts so they are ready to go when funding opportunities become available
- Educational research foundation and use of RSA

Capabilities Developed/Contd.

NSF Proposals / Grant Development

- Deeper understanding of NSF goals, priorities, and programs
- Comfortable calling NSF Program Officers for feedback on concepts, proposals and implementation
- Use of formal, structured proposal development processes
- Ability to effectively construct proposals and express ideas at the level expected for NSF proposals
- Knowledge of supporting infrastructures required to meet NSF expectations e.g., budgeting, financial and grants management, reporting

KickStarter's Broader Impacts



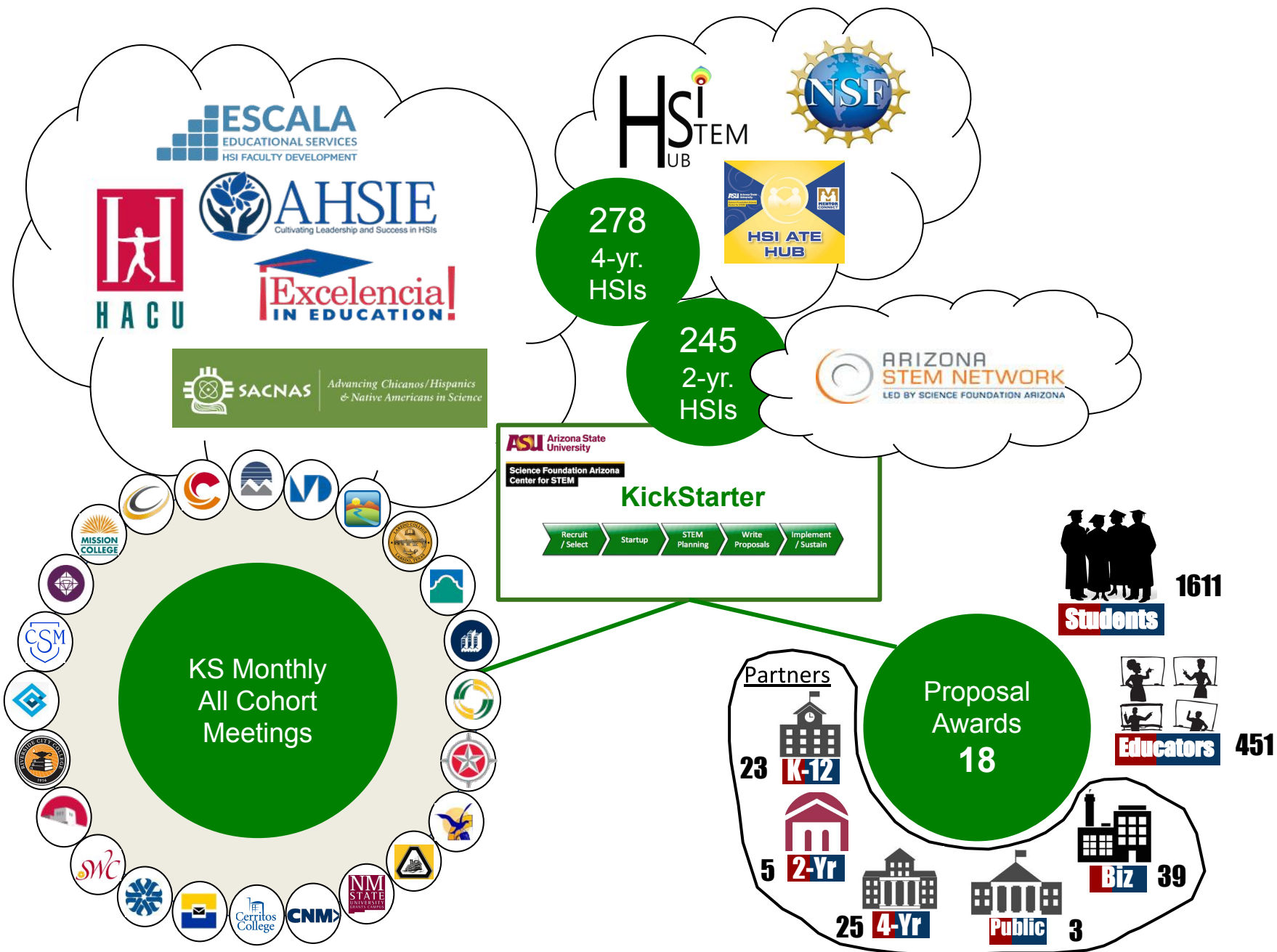
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KickStarter's Broader Impacts

This project increased the numbers of 2-yr HSIs that successfully pursue federal grants, particularly from the National Science Foundation, ultimately increasing recruitment and retention in STEM through enhancements to these institutions' STEM curricula, strengthening ties to industry and community partners, and developing robust articulation pathways to four-year STEM programs.

This technical assistance model may be adapted for other minority-serving community colleges, such as two-year Historically Black Colleges and Tribal Colleges and for four-year HSIs as well.

Broader Impacts through Connectedness



KickStarter Success Stories



**Science Foundation Arizona
Center for STEM**

Increasing the Student Biotech Pipeline

May 1, 2017 – April 30, 2020

Goals:

Prepare *community college and high school* students for jobs in biotechnology by developing new programs that address skill development and offer students *counseling, tutoring, industry field trips, external speakers, and internship opportunities*.

Outcomes:

- Prepare students for entry-level, middle-skill technician positions
- Provide underrepresented students with employment opportunities
- Measured by: Student progression, success, retention, degree attainment & employment

- **Par Mohammadian, Life Science Faculty**

MohammP@lamission.edu

- **Chander Arora, Life Science Faculty**

AroraCP@lamission.edu



Los Angeles Mission College, Dept. of Life Sciences

Outcomes of being part of Cohort #1:

- Increasing the Student Biotech Pipeline (NSF ATE award # 1700152) (May 01, 2017 – April 30, 2020)
- Biotech students placed in top 10 NSF Community College 2018 Innovation projects in 2018
- An Intervention to Improve Success of Biology Majors in Mathematics (NSF HSI award #1832348) (Oct 1, 2018 - Sep 30, 2023)





ALAMO COLLEGES DISTRICT

Palo Alto College



ALAMO
COLLEGES
DISTRICT



Achieving
the Dream | LEADER
COLLEGE



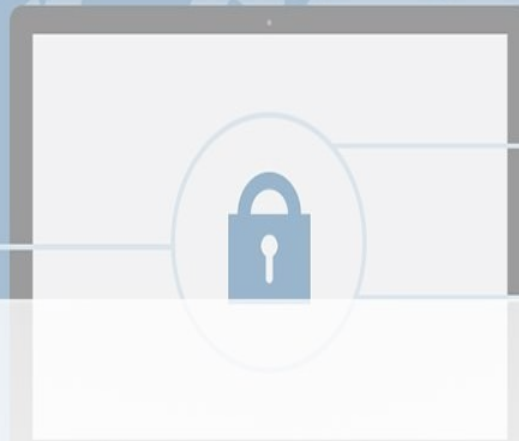
- Located in San Antonio, Texas
- Enrollment 9,870 students
- Hispanic enrollment: 7,857

Leveraging Supply Chain and Logistics Emerging Technologies to Appeal to a Millennial Workforce

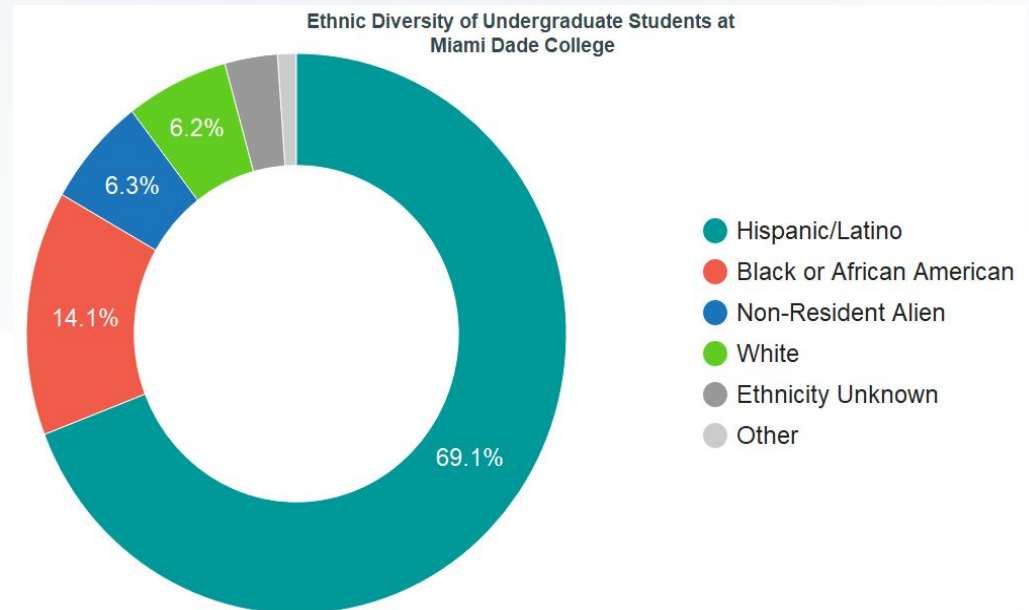
- Number of students: 100 undergraduate, 1,350 pre-college
- Proposed interventions: logistics and supply chain activities to middle school and high school students
 - Lifesaver Game and Supply Chain Software practice
- Desired outcome: To turn upside down the traditional method of introducing career and technical program to secondary school students.
- Proudest moments to date:
 - Twenty eight students taking 6 hours of logistics classes in high school.
 - 2+2 Agreement signed with Wayland Baptist University for students to transfer with the AAS in Logistics and Supply Chain plus 12 additional hours into Wayland's BAAS in Logistics & Supply Chain.

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Founded in 1959, Miami Dade is the largest college in the [Florida College System](#) with over 165,000 students. Additionally, MDC is also the largest institution of higher education in Florida, and the second-largest in the United States. Miami Dade College's main campus, the [Wolfson Campus](#), is in [Downtown Miami](#).



Cybersecurity Opportunities and Methods that Promotes Access to Student Success (COMPASS)



Goal:

Increase the number of underrepresented minorities entering the cybersecurity workforce by developing capacity to support and implement a pathway for underrepresented minority first-time in college and non-traditional students affordable access to a state approved one year College Credit Certificate and/or a two-year Associate in Science degree in cybersecurity.



Diego Tibaquirá, Professor of Computer Science - MDC

- Former United States Marine
- Graduated from a University with the Center for Academic Excellence in Cybersecurity Designation
- Graduate Certificate in Privacy and Security sponsored by the NSA
- Worked for the Federal Government as Information Security Specialist
- Principal Investigator of NSF Grant #[1800958](#) - COMPASS





Success Stories: Pima CC

NSF HSI Award: Enhancing Introductory Biology with the Arizona Insect DNA Barcoding Course-Based Undergraduate Research Experience - Jennifer Katcher, PI. **Pima's first NSF grant in nearly two decades -- will enhance the students' research experience by providing opportunities to be paid, serve as peer mentors, and travel to national conferences.** The research experience for students is a fascinating one: helping the **Arizona-Sonora Desert Museum** to conserve bees. Critically, the grant will help gauge if the research experience improves students' resilience and persistence by giving them the opportunity to overcome the failures that are inevitable in any scientific inquiry and see themselves as scientists because they have been immersed in the world of research.



PimaCommunityCollege



Write
Proposals

Success Stories: Southwestern

SSTEM DUE 1929756, a \$3.2M award to Southwestern College, PI: David Hecht, co-PIs Alex Hofler, Mourad Mjahed.

Over five years, this project will fund 120 scholarships to four groups of 30 students who are pursuing associate degrees at Southwestern College, and 45 scholarships for 30 transfer students and 15 graduate students who are pursuing baccalaureate and graduate degrees in chemistry and biochemistry at San Diego State University. **This project will create an integrated mentoring and research pathway that bridges the chemistry and biochemistry programs at Southwestern College and San Diego State University.**





Success Stories: Central New Mexico



NSF Award #1928368. Developing Meaningful Mathematics for Student Success Through a **Collaboration Between Community College and High School Faculty.**

CNM's HSI Proposal had a declination prior to KickStarter. It was totally re-written, strengthening the educational research component in particular and was awarded. CNM, while having a history of success, is learning how to intentionally serve their STEM students.



Success Stories: Central Arizona College

Central Arizona College was awarded a \$225,000 Advanced Technological Education (ATE) award from the National Science Foundation. **In collaboration with industry partners, the program, led by Gary Gardner (Principal Investigator), will develop and pilot curricula for an advanced fabrication and joining program to prepare Advanced Welding Process Technicians.** Since the college is both an Hispanic Serving Institution and a rural community college, this project will strive to encourage students from minority backgrounds to pursue science, technology, engineering, and mathematics (STEM) credentials. The curriculum, STEM content, and project-based learning exercises will be shared with the National Center for Welding Education and Training, the seven Hispanic Serving Institutions participating in the Science Foundation Arizona KickStarter project, and other community colleges. See DUE 1800826.





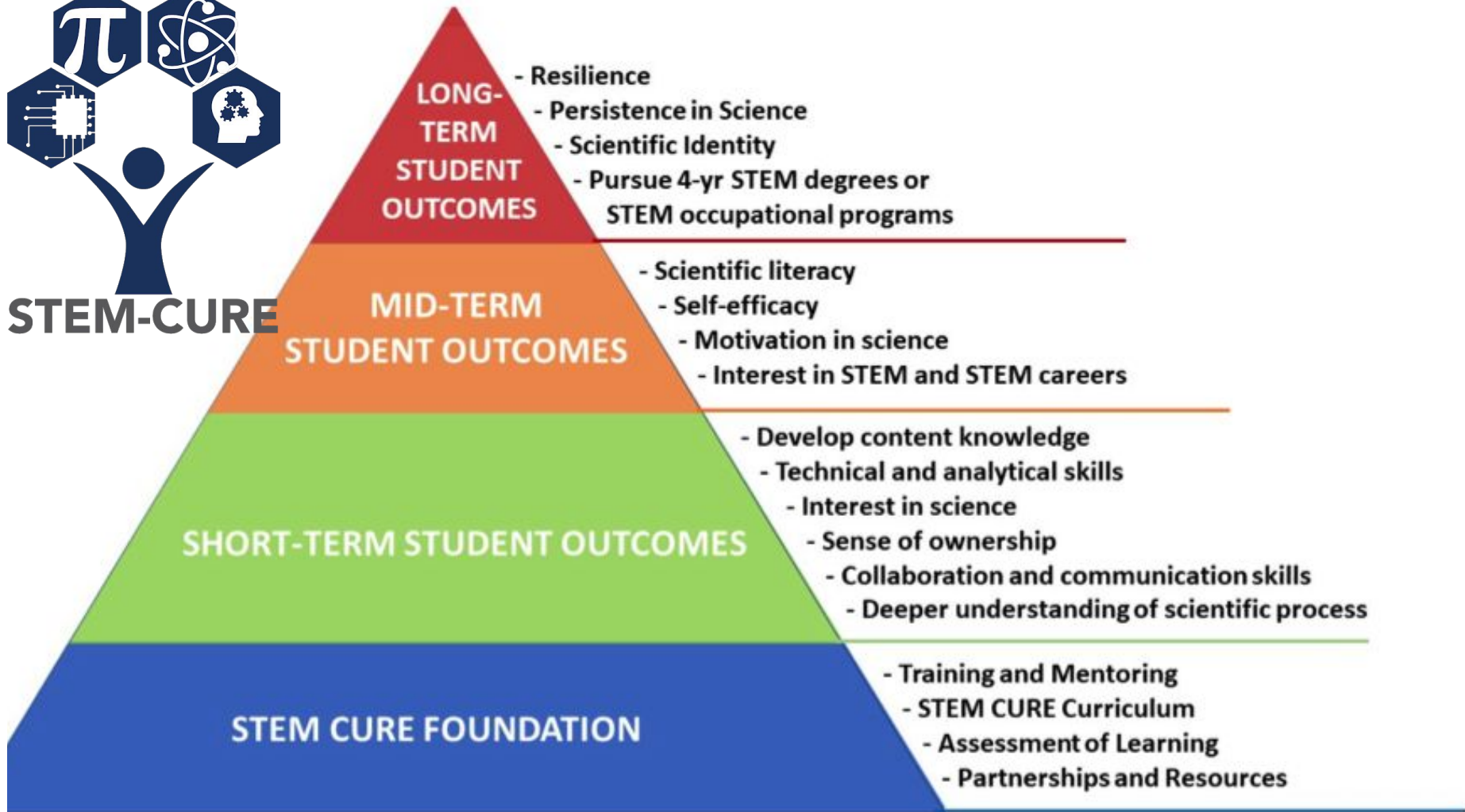
PHOENIX COLLEGE

A MARICOPA COMMUNITY COLLEGE

Integrating Research, Mentoring, and Industry Collaborations to Improve STEM Recruitment and Retention - NSF #1832543 Jan 1, 2019 - Dec 31, 2023. \$1.5M award for partnership among PC, ASU West and USDA.



STEM-CURE



Lessons Learned

Overall

- The process of starting from a strategic foundation and a self assessment leads to strong, well supported concepts that lead to successful proposals
- Faculty and staff professional development is needed to be competitive for NSF-level funding
- Tools including self assessment, STEM Plans, CSA, RSA, logic models, and proposal checklists all help
- Engage with NSF - talk to POs, utilize websites and webinars, and become a reviewer!!

STEM Planning

- Include a diverse team, with broad representation to gather diverse perspectives and examples
- Build from College Strategy. Understand who you are, using data.
 - What are the needs of your targeted students?
 - What are your local industry needs?
 - Who are your potential community and academic partners and their roles/contributions

Concept Development

- Project champion and PI roles are essential
- Use Educational Research Tools
 - Research Study Approach
 - Common Guidelines for Educational Research
- Start early. Expect 6-12 months to develop a concept from initiation into a submitted proposal. NOTE: 90 day window for new NSF solicitations
- Start small. Develop a 'roadmap' or a portfolio of project ideas that build on each other over time

Proposal Development and Submittal

- Use a structured proposal development process, including checklists!
- Team approach when possible (divide and conquer)
- Engage external evaluators and educational researchers as early as possible in the process
- Faculty engagement is essential (college culture must support faculty engagement)
- Use people external to the project to review proposal prior to submission ('red team review')
- Start uploading a week ahead of deadline. Finish a day ahead. NSF has a 2-step submittal process

Sustainable Practices

- Take local, regional, and national needs and trends into account while linking to the college strategy
- Rely upon administrative support for a robust concept and proposal development process, with an understanding of the time and training needed
- Continue STEM team meetings shifting membership as needed to grow the Community of Practice

Sustainability

- STEM teams: evolving membership to meet institutional needs, sometimes absorbed into existing structures/forums/communities at the institution
- A team trained in concept development, educational research, and proposal development, with access to self-guided training to bring new members up to speed
- A clear set of priorities, well articulated and supported by administration
- A portfolio of ideas from which to build concepts and proposals for additional grant awards

Working with NSF

- First submissions are often NOT funded. Don't give up. Keep a long term view
- Interact with NSF POs and NSF website to better understand NSF's funding priorities and programs
- Utilize the "New To" programs when applicable
- Contact NSF support centers for each program (e.g., K-12: DRK12 - CADRE and ITEST - STELAR. ATE: ATE Centers, Eval-u-ate, and Mentor Connect. HSI - HSI Stem Hub)
- NSF evolving to be more supportive of HSIs and Community Colleges - you are welcome there!

KS Into the Future

- *Sign up/ leave your business card to be included on the Recruitment lists for the above institutes.*
- Rural HSI Conference (NSF #1940949), June 2020. Document challenges and best practices specific to HSIs and emerging HSIs that are rural
- STEM-ESS Institute (April 2020). Sponsored by Excelencia in Education, the next evolution of the SFaz STEM assessment and planning extends the KickStarter approach with intentional planning and demonstration of STEM strategies and practices that are evidence-based and student serving (STEM-ESS).
- AHSIE NSF Grantsmanship Institute (Jan 2019, Jan 2020, and beyond, Scottsdale, AZ)
- STEM Network (stem.sfaz.org)
- Additional fee-for-service and potential grant-supported KickStarter activities

Questions and Answers



**Science Foundation Arizona
Center for STEM**

Thank You



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