Getting to Know NSF

AHSIE
Grantsmanship Institute

March 25, 2018

Science Foundation Arizona
Caroline VanIngen-Dunn
Anna Tanguma
Cynthia Pickering

The Panel
LeRoy Jones, NSF
Joseph E. Hibdon,
Northeastern Illinois University

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Objective

Provide an understanding of National Science Foundation (NSF) proposal requirements and an introduction to some KickStarter tools that address these requirements.

Outline

- Who we are: NSF, SFAz, KickStarter
- NSF Proposal Requirements
- KickStarter Overview
- Research Study Approach
- NSF Funding Opportunities
- NSF Panel
- Audience Q & A

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National Science Foundation

- An independent federal agency **created by Congress in 1950** to "promote the progress of science; advance the national health, prosperity, and welfare; secure the national defense…"
- Supports basic research and people to **create knowledge that transforms the future**
- New HSI Program - Improving Undergraduate STEM Education (IUSE): **HSI Program to enhance the quality of undergraduate STEM education at HSIs** *(Monday Session, 11am - Noon)*

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NSF Grants Process

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NSF Merit Review Process

- Independent team of reviewers
  - Chosen by Program Officer from a pool of applicants
  - Need more reviewers with CC experience
- Reviewers consider what proposers
  - Want to do and why
  - How they plan to do it and know if they succeed
  - What benefits accrue if project is successful
- Review is based on 2 Categories:
  - Intellectual Merit
  - Broader Impact

Intellectual Merit

The potential to generate and advance new knowledge

- A concise statement about the original contributions of the proposed research
- Originality, creativity, ability to transform
- References relevant literature in the field
- References other NSF-funded initiatives, as appropriate

Broader Impact

- The potential to benefit society and contribute to the achievement of specific, desired societal outcomes
- How the research can have a broader impact on human resources
- Ways to broaden the impact of your work may include:
  - Outreach to K-12
  - Outreach to under-served populations
  - Contribution to your Community
  - Development of a Model that others can apply

Science Foundation Arizona

Provide services for maximizing the educational and economic impact of STEM

- Non-profit founded in 2006 by industry leaders and state government to diversify the economy through investments in state-based research and education.
- An affiliate of ASU's Innovation Center (SkySong), home to a diverse community that links technology, research, education and entrepreneurship.
- Developed and tested a comprehensive *KickStarter* process that is proving effective in assisting CC-HSIs

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KickStarter Program (HRD#1450661)

- NSF-funded Pilot program, 4yr, $1.8M
- Assist community college HSIs *new to NSF* with STEM planning, concept development, *proposal preparation* and submission *(Monday Session)*
- Desired outcomes:
  - More CC-HSIs compete successfully on NSF projects
  - CC-HSIs strengthen their STEM infrastructure
  - Key *partnerships* are established that improve competitiveness
  - KickStarter process is sustainable

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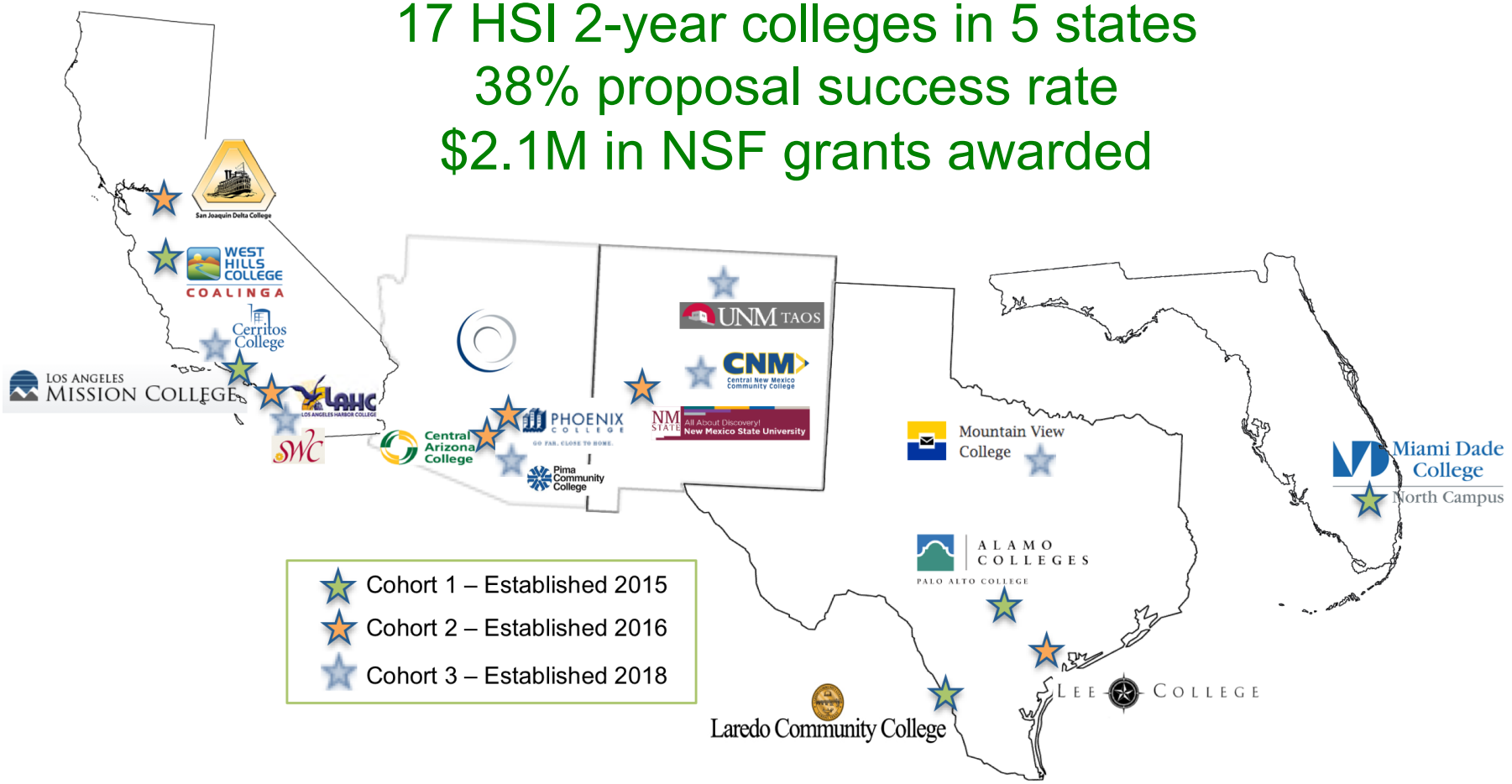
KickStarter Colleges

17 HSI 2-year colleges in 5 states
38% proposal success rate
$2.1M in NSF grants awarded



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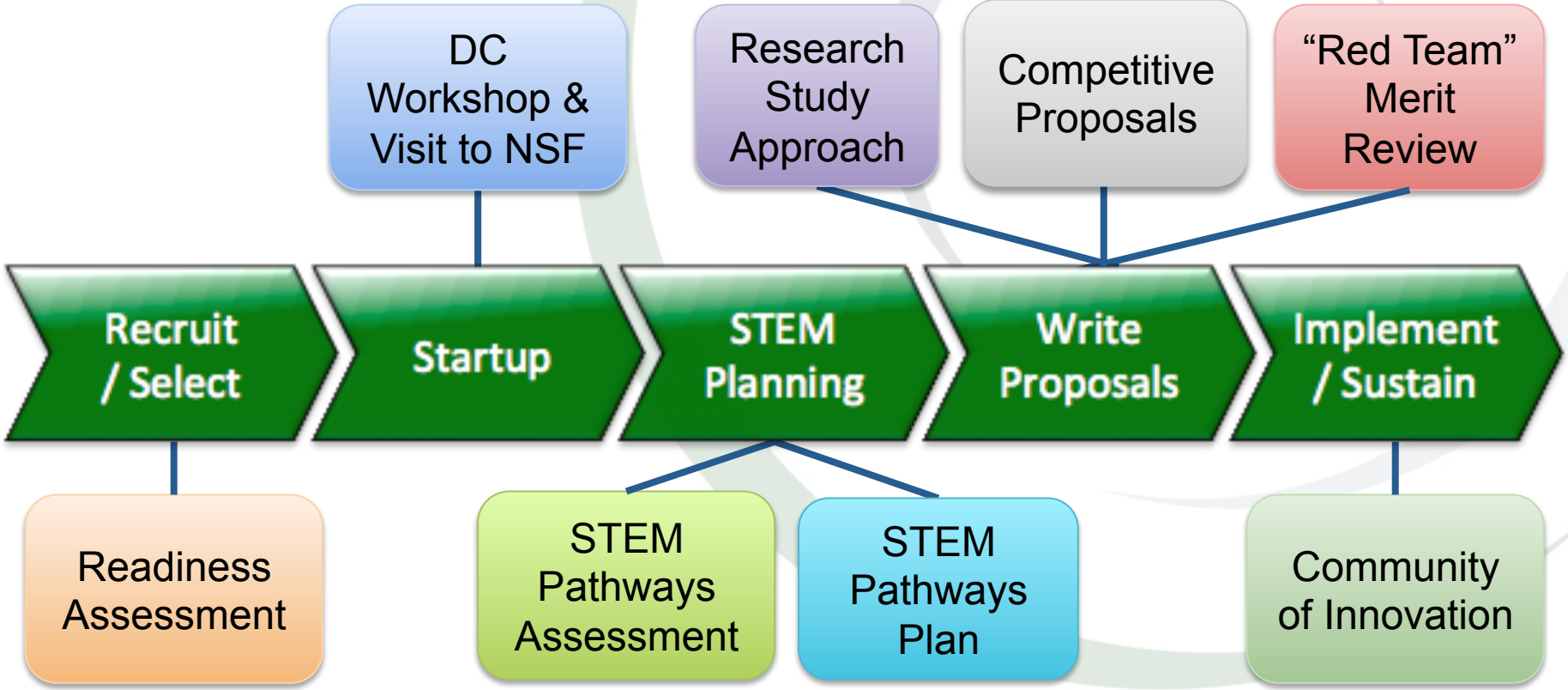
Repeatable KickStarter Process

(Monday Session)



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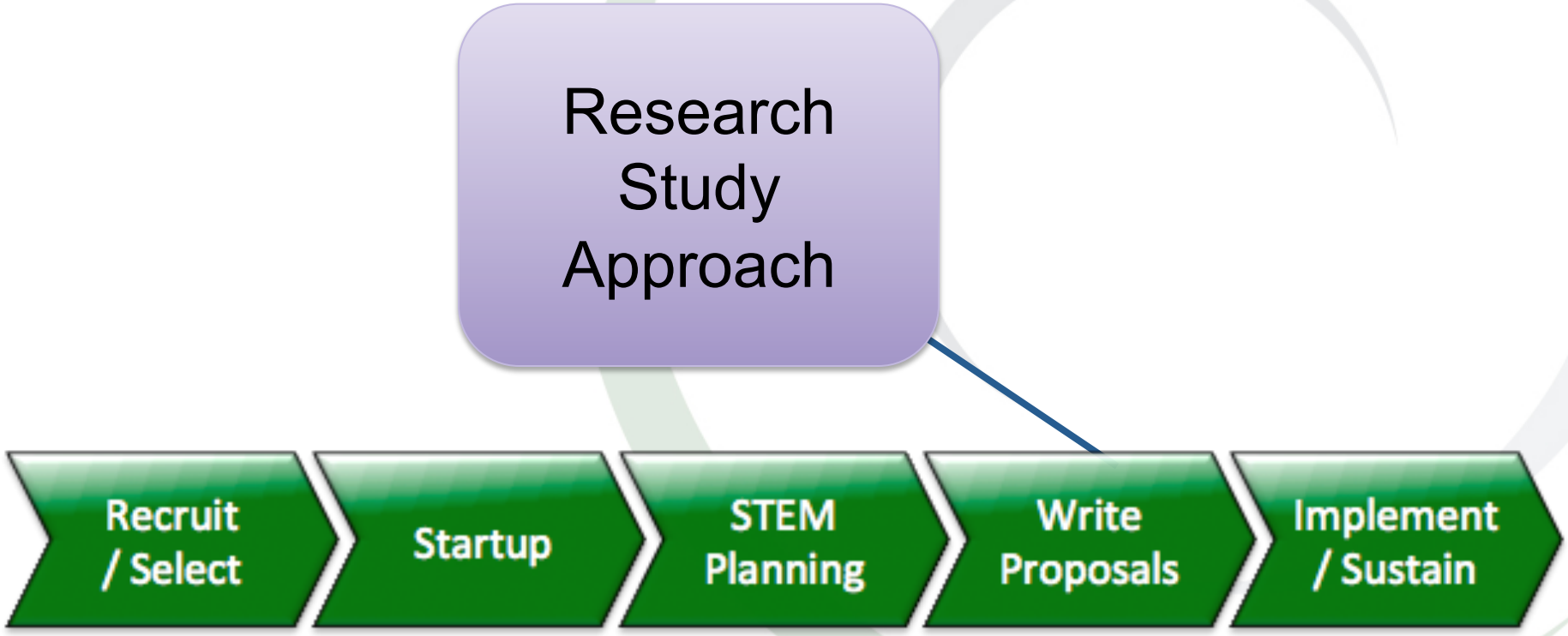
Research Study Approach



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Why Adopt a Research Study Approach (RSA)?

- Efficiently translate what the College wants to do into an approach that comprehends NSF requirements
- Increase potential for competitive College proposal submissions via early:
  - Emphasis on generation of new knowledge
  - Formulation of strong research question(s)

NSF Requirements

- Rigorous research and evaluation in support of excellence in STEM education
- Advances knowledge in the field
- Impacts and benefits audiences beyond the immediate participants in the study
- Cohesive, systems approach
- Evidence-Based / Evidence-Generating

Education Research - Definition

- The application of the scientific method to study and solve educational problems.
- Explains, predicts and/or controls educational phenomena to discover new knowledge and make changes that will advance the welfare of society.
- NSF Common Guidelines for Education Research and Development

Education Research - Contrasts

- Studies individual behaviors and group behaviors and impacts on each other in an education context

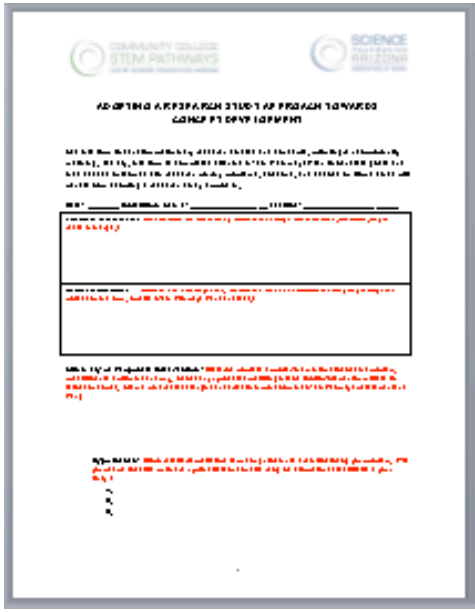
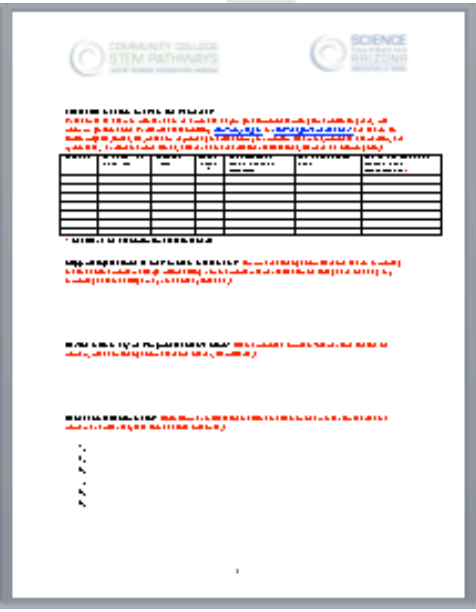
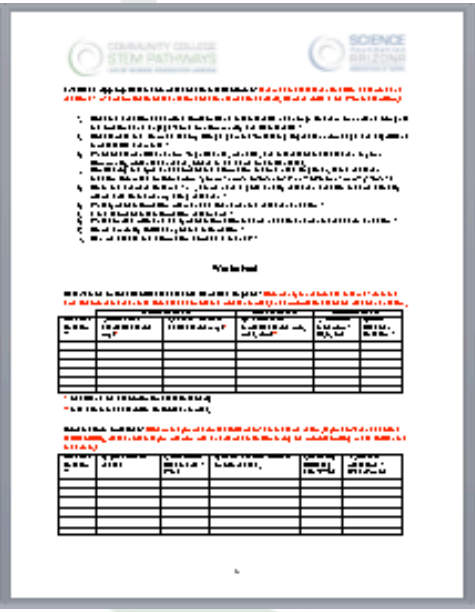
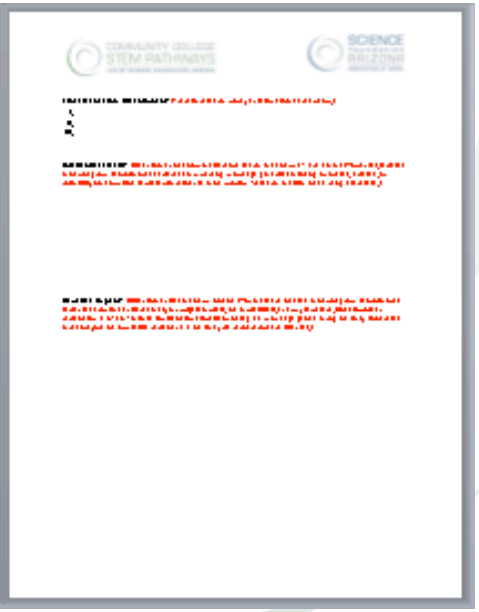
- Observation of human behavior is more subjective than observation of physical or biological phenomena.

- The subjectivity of the observer has a direct impact on the interpretation and findings from which conclusions are formed.

Write Proposals

RSA Phases and Template

RSA Template

1. Initial Concept Ideation	2. Literature Search/ Review of Prior Art	3. Research Question Development	4. Intellectual Merit Broader Impact
			
State Problem, Intervention, Outcome	***Prior Art, Partners, Unique Contributions***	***Create and Qualify Research Questions***	***Advance Knowledge and Benefit Society***

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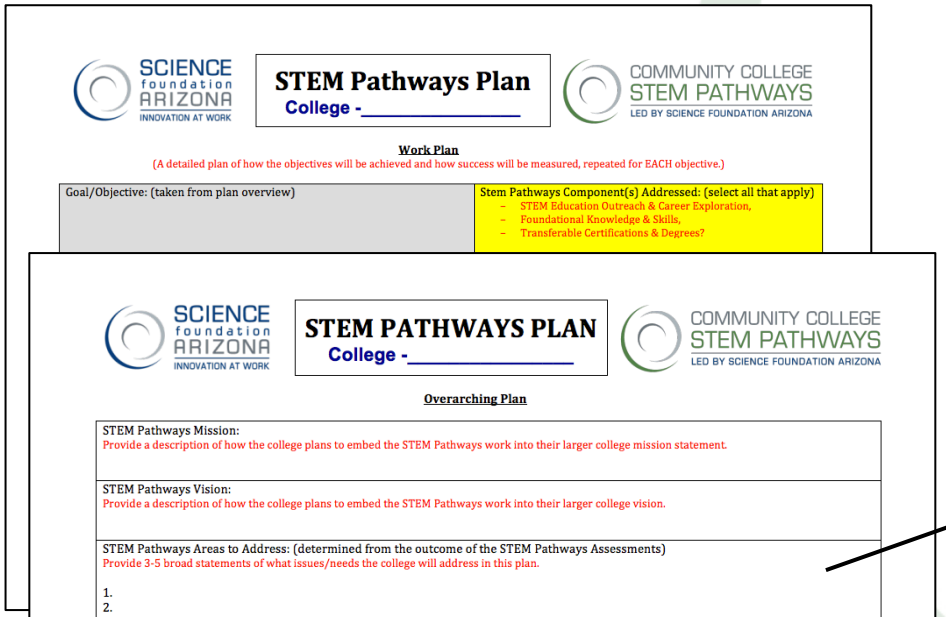
1. Initial Concept / Ideation



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STEM Pathways Plan
College -_____

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Work Plan
(A detailed plan of how the objectives will be achieved and how success will be measured, repeated for EACH objective.)

Goal/Objective: (taken from plan overview)	Stem Pathways Component(s) Addressed: (select all that apply) – STEM Education Outreach & Career Exploration, – Foundational Knowledge & Skills, – Transferable Certifications & Degrees?

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STEM PATHWAYS PLAN
College -_____

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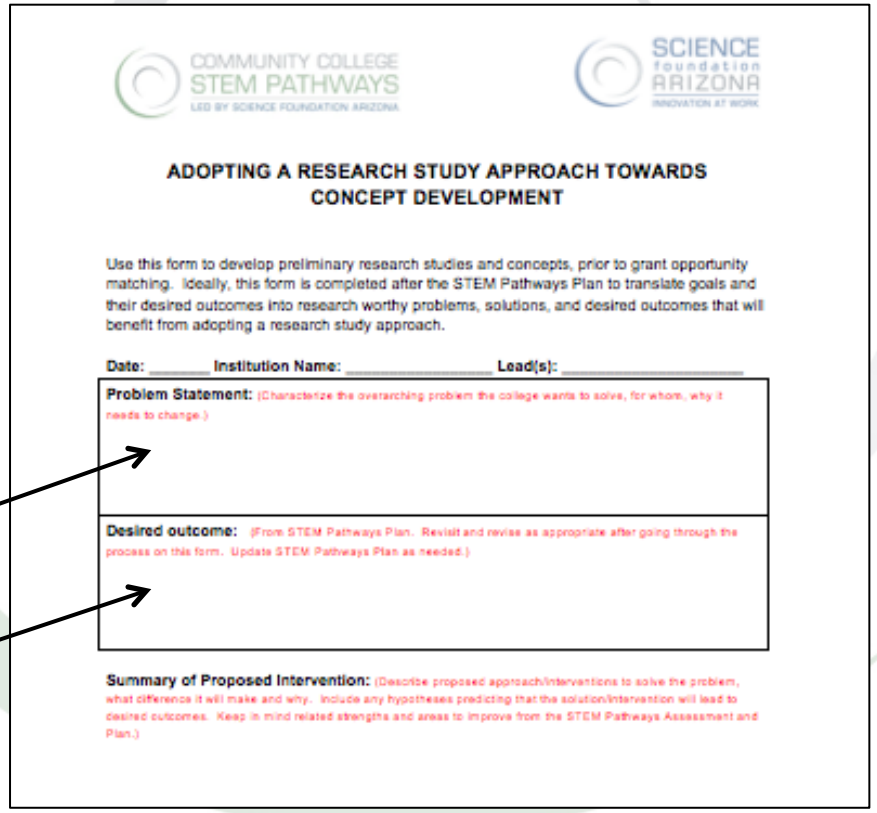
Overarching Plan

STEM Pathways Mission: Provide a description of how the college plans to embed the STEM Pathways work into their larger college mission statement.
STEM Pathways Vision: Provide a description of how the college plans to embed the STEM Pathways work into their larger college vision.
STEM Pathways Areas to Address: (determined from the outcome of the STEM Pathways Assessments) Provide 3-5 broad statements of what issues/needs the college will address in this plan. 1. 2. 3. 4. 5.
Desired STEM Pathways Goals/Objectives: (desired outcomes connected to the Areas to Address and STEM Pathways Components) Provide 3-5 **broad** but **measureable** desired changes in programs, impact of programs, relationships etc. to be made 1. 2. 3. 4. 5.



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ADOPTING A RESEARCH STUDY APPROACH TOWARDS CONCEPT DEVELOPMENT

Use this form to develop preliminary research studies and concepts, prior to grant opportunity matching. Ideally, this form is completed after the STEM Pathways Plan to translate goals and their desired outcomes into research worthy problems, solutions, and desired outcomes that will benefit from adopting a research study approach.

Date: _____ **Institution Name:** _____ **Lead(s):** _____

Problem Statement: (Characterize the overarching problem the college wants to solve, for whom, why it needs to change.)

Desired outcome: (From STEM Pathways Plan. Revisit and revise as appropriate after going through the process on this form. Update STEM Pathways Plan as needed.)

Summary of Proposed Intervention: (Describe proposed approach/interventions to solve the problem, what difference it will make and why. Include any hypotheses predicting that the solution/intervention will lead to desired outcomes. Keep in mind related strengths and areas to improve from the STEM Pathways Assessment and Plan.)

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2. Literature Search

Serves as a launch point to:

- Understand prior art
- Identify potential partners
- Avoid reinventing the wheel
- Strengthen your research questions
- Rationalize your unique contributions
- Provide the basis for creating / extending a model that others can use
- Re-use it and extend it during proposal writing

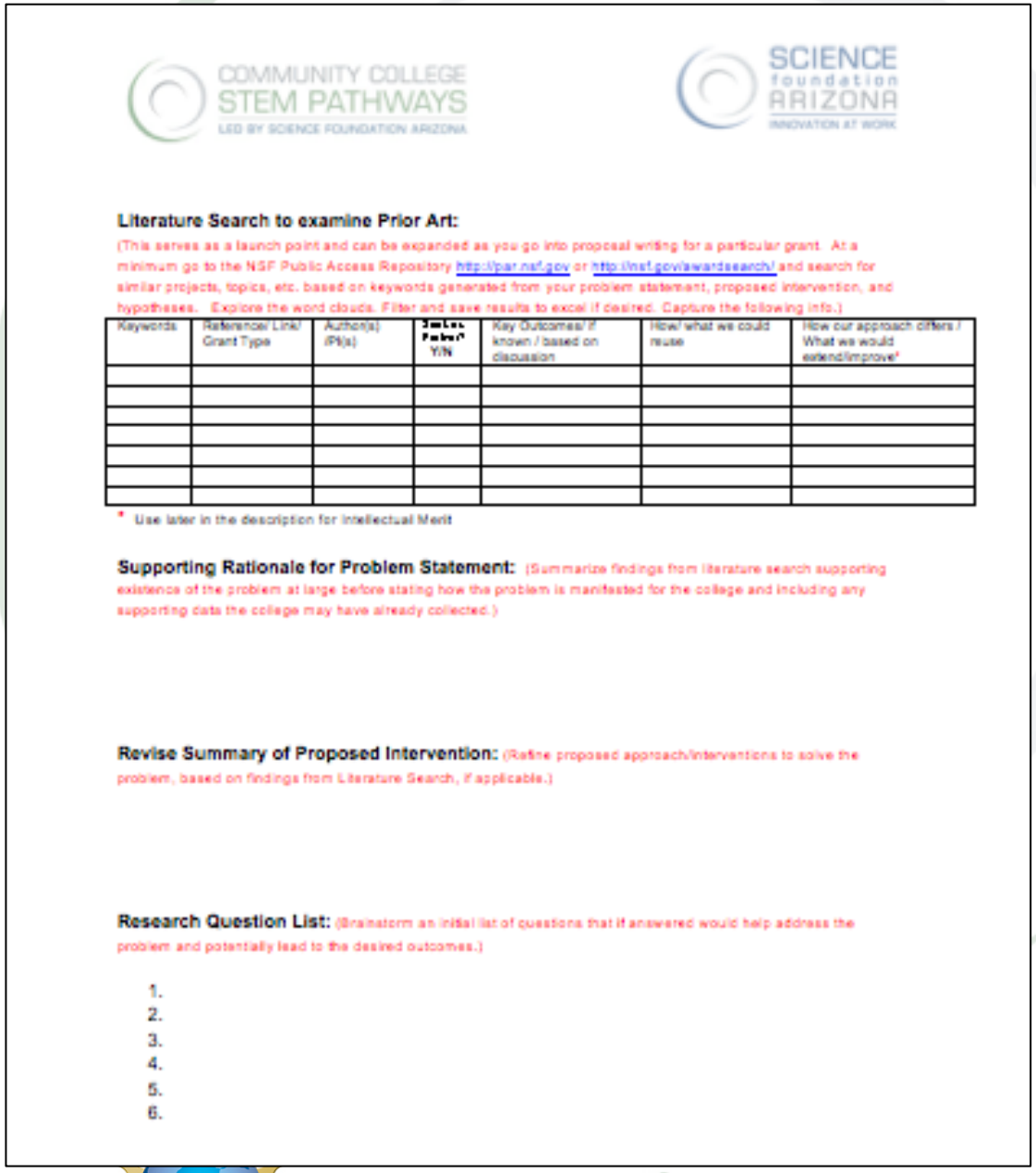
More Literature Search Guidance

- Use repositories you are familiar with for your field
- Also use NSF Public Access Repository (PAR)
  - par.nsf.gov
  - nsf.gov/awardsearch/
- Search for similar projects, topics, etc. based on search terms generated from your problem statement, proposed intervention, and hypotheses
- Refine your search using available filters, e.g. location
- Save results to Excel for further analysis, if desired
- Take notes in the RSA Template
- Contact / talk with researchers if there is reuse potential
- Plan to expand and refine during proposal writing

2. Literature Search Notes

and

3. Initial Research Questions List



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Literature Search to examine Prior Art:

(This serves as a launch point and can be expanded as you go into proposal writing for a particular grant. At a minimum go to the NSF Public Access Repository http://par.nsf.gov or http://nsf.gov/awardsearch/ and search for similar projects, topics, etc. based on keywords generated from your problem statement, proposed intervention, and hypotheses. Explore the word clouds. Filter and save results to excel if desired. Capture the following info.)

Keywords	Reference/ Link/ Grant Type	Author(s) (PI(s))	[illegible] Y/N	Key Outcomes/ If known / based on discussion	How/what we could reuse	How our approach differs / What we would extend/improve*

* Use later in the description for Intellectual Merit

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

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

Research Question List: (Brainstorm 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.

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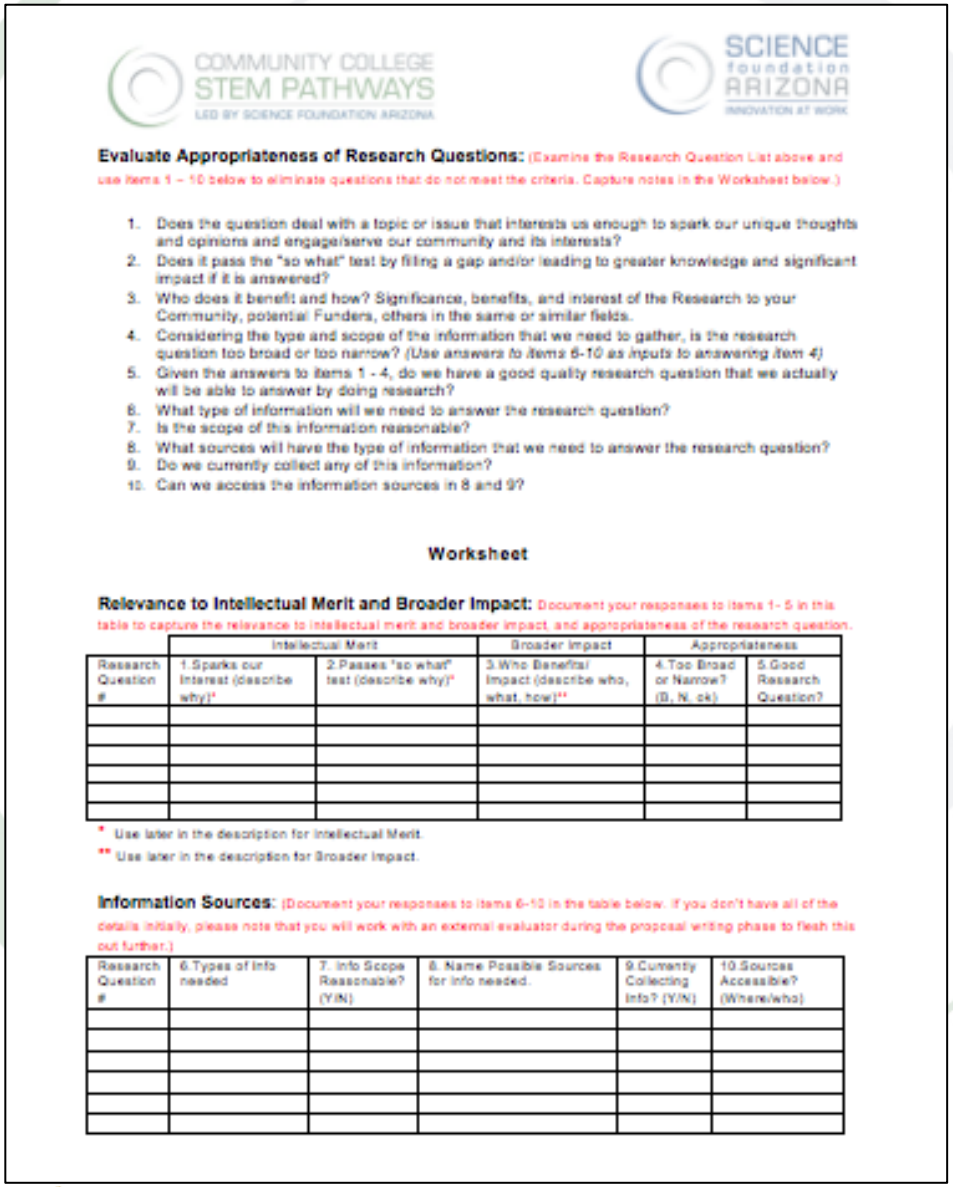
3. Validating initial Research Questions

and

Identifying Information/ data Sources



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Evaluate Appropriateness of Research Questions: (Examine 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 doing 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?

Worksheet

Relevance to Intellectual Merit and Broader Impact: Document your responses to items 1- 5 in this table to capture the relevance to intellectual merit and broader impact, and appropriateness of the research question.

	Intellectual Merit		Broader Impact	Appropriateness	
Research Question #	1.Sparks our Interest (describe why)*	2.Passes "so what" test (describe why)*	3.Who Benefits/ Impact (describe who, what, how)**	4.Too Broad or Narrow? (B, N, ok)	5.Good Research Question?

* Use later in the description for Intellectual Merit.

** Use later in the description for Broader Impact.

Information Sources: (Document your responses to items 6-10 in the table below. If you don't have all of the details initially, please note that you will work with an external evaluator during the proposal writing phase to flesh this out further.)

Research Question #	6.Types of Info needed	7. Info Scope Reasonable? (Y/N)	8. Name Possible Sources for Info needed.	9.Currently Collecting Info? (Y/N)	10.Sources Accessible? (Where/who)

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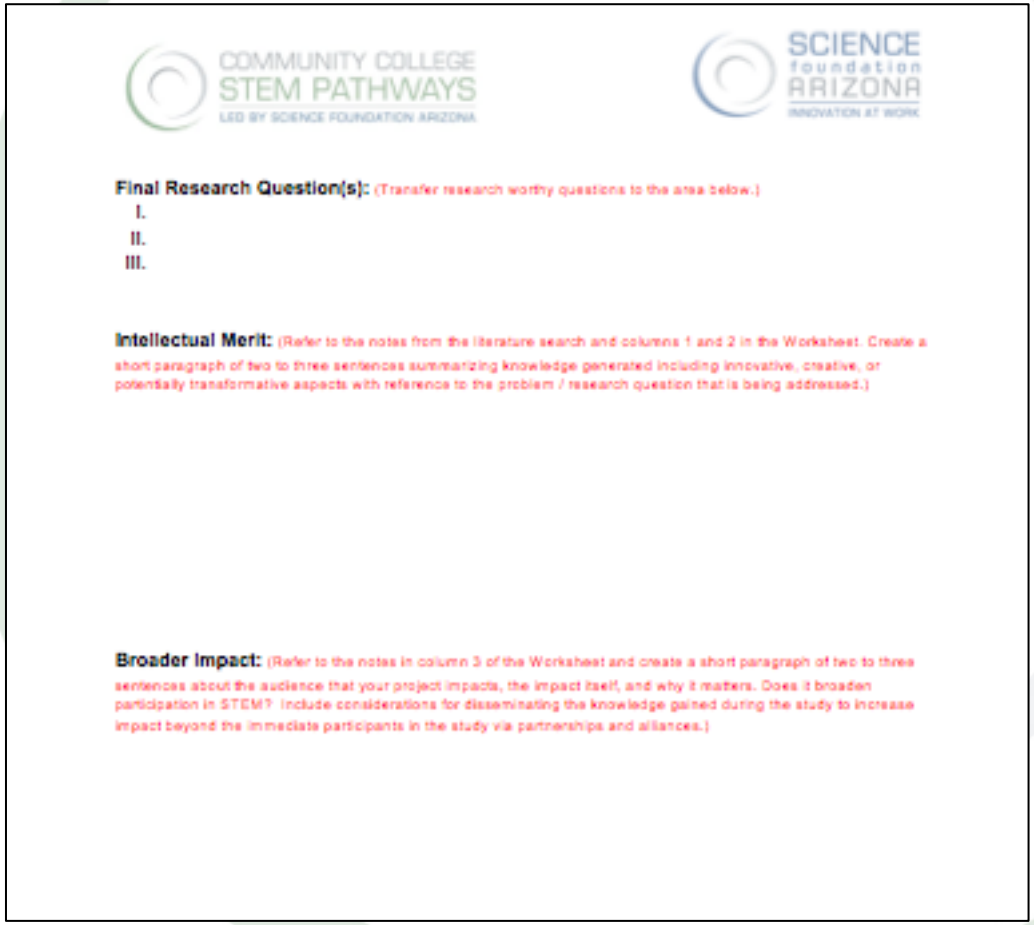
4. Final Research Questions,

Intellectual Merit,

and

Broader Impact



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Final Research Question(s): (Transfer research worthy questions to the area below.)

I.
II.
III.

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 summarizing knowledge generated including innovative, creative, or potentially transformative aspects with reference to the problem / research question that is being addressed.)

Broader Impact: (Refer to the notes in column 3 of the Worksheet and create a short paragraph of two to three sentences about the audience that your project impacts, the impact itself, 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 partnerships and alliances.)

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NSF Programs
(Funding Opportunities)

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NSF Programs – S-STEM

Scholarships in Science, Technology, Engineering, and Mathematics Program

- Goal: increase the success of low-income academically talented students pursuing STEM associate, baccalaureate, or graduate degrees
- 40/60% Split between student support programs and scholarships
- Award Rate: ~20%

NSF Programs – ATE

Advanced Technological Education

- Emphasis: 2-year colleges and educating technicians for high-tech fields driving the nation's economy
- Must involve industry
- Award Rate: First time ATE ~70%

NSF Programs - MRI

Major Research Instrumentation

- Catalyzes new knowledge and discoveries by empowering the Nation's scientists and engineers with state-of-the-art research instrumentation
- Enables research-intensive learning environments that promote the development of a diverse workforce and next generation instrumentation, as well as facilitates academic/private sector partnerships.

NSF Programs - IUSE

Improving Undergraduate STEM Education

Goals:

- Address immediate challenges and opportunities facing undergraduate STEM education
- Anticipate new structures and new functions of the undergraduate learning and teaching enterprise

Tracks	Tier 1	Tier 2
1. Engaged Student Learning	Exploration and Design	Development and Implementation
2. Institutional and Community Transformation	Exploration and Design	Development and Implementation

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NSF Programs - HSI

Goals:

- Enhance the quality of undergraduate STEM education at HSIs
- Increase retention and graduation rates of undergraduate students pursuing degrees in STEM fields at HSIs
- Build capacity at HSIs that typically do not receive high levels of NSF grant funding

Tracks: 1) Building Capacity 2) HSIs New to NSF

NSF Programs - ADVANCE

Increasing Participation and Advancement of Women in Academic Science and Engineering Careers

Goals:

- Develop systemic approaches to increase the representation and advancement of women in academic STEM careers
- Develop innovative and sustainable ways to promote gender equity in STEM academic workforce
- Contribute to the development of a more diverse science and engineering workforce

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NSF Programs - ITEST

Innovative Technology Experiences for Students and Teachers

- Aimed at PreK-12 student interests and capacities to participate in STEM and information communications technology (ICT) workforce.
  - Awareness, motivation, content and skills
  - http://stelar.edc.org/

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NSF Programs - ECR

Engineering Core Research

- Fundamental research in STEM education:
  - STEM learning
  - STEM learning environments
  - STEM workforce development
  - Broadening participation in STEM

NSF Programs - LSAMP

Louis Stokes Alliances for Minority Participation

- Assist universities and colleges diversify the STEM workforce by increasing the number of STEM baccalaureate and graduate degrees awarded to historically under-represented populations
- Alliance Focus

NSF Programs - EAGER

- Support exploratory work in its early stages on untested, but potentially transformative, research ideas or approaches.
- Application of new expertise or engages novel disciplinary or interdisciplinary perspectives.

NSF Programs – REU

Research Experience for Undergraduates

- Supports active research participation by undergraduate students in any of the areas of research funded by NSF
- Due date: 4th Wednesday in August
- BUT – individual students should apply NOW for summer research positions

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NSF Funding Realities

- Significant efforts and attention paid towards broadening participation - community colleges, HSIs, under-served populations, increasing diversity in STEM.
- Average proposals funded: ~22%
- Expectation is that a first-time proposal will not be awarded. Multiple attempts are expected and encouraged.

NSF Details

- NSF Programs Websites include:
  - Program Overview
  - Program Officers Contact Information
  - Solicitations
  - Webinars
  - Prior Awards

- NSF Proposal & Award Policies & Procedures Guide (PAPPG)
  - Provides NSF specific requirements
  - If you do not meet the requirements, your proposal will not be reviewed.

NSF Panel

Joseph E. Hibdon, Assistant Professor
Northeastern Illinois University
J-hibdonjr@neiu.edu

LeRoy Jones
NSF Program Officer, LSAMP
ljones@nsf.gov

Questions for NSF Panel

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Audience Questions?

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Monday, 11:00am
Invited Speaker Session
UIC Forum G

Resources, Strategies, and Funding Opportunities for HSIs at NSF

Presentation by:
Caroline VanIngen-Dunn, Science Foundation Arizona
and
Dr. Talitha Washington, Program Officer HSI Program
National Science Foundation

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EXTRA SLIDES

Steps involved in Literature Review

- Re-examine and consider Problem Statement
- Skim through some relevant secondary sources*
- Peruse one or two general reference** works
- Formulate search terms pertinent to research question
- Search general references for relevant primary sources***
- Read, take notes, and summarize key points in the sources

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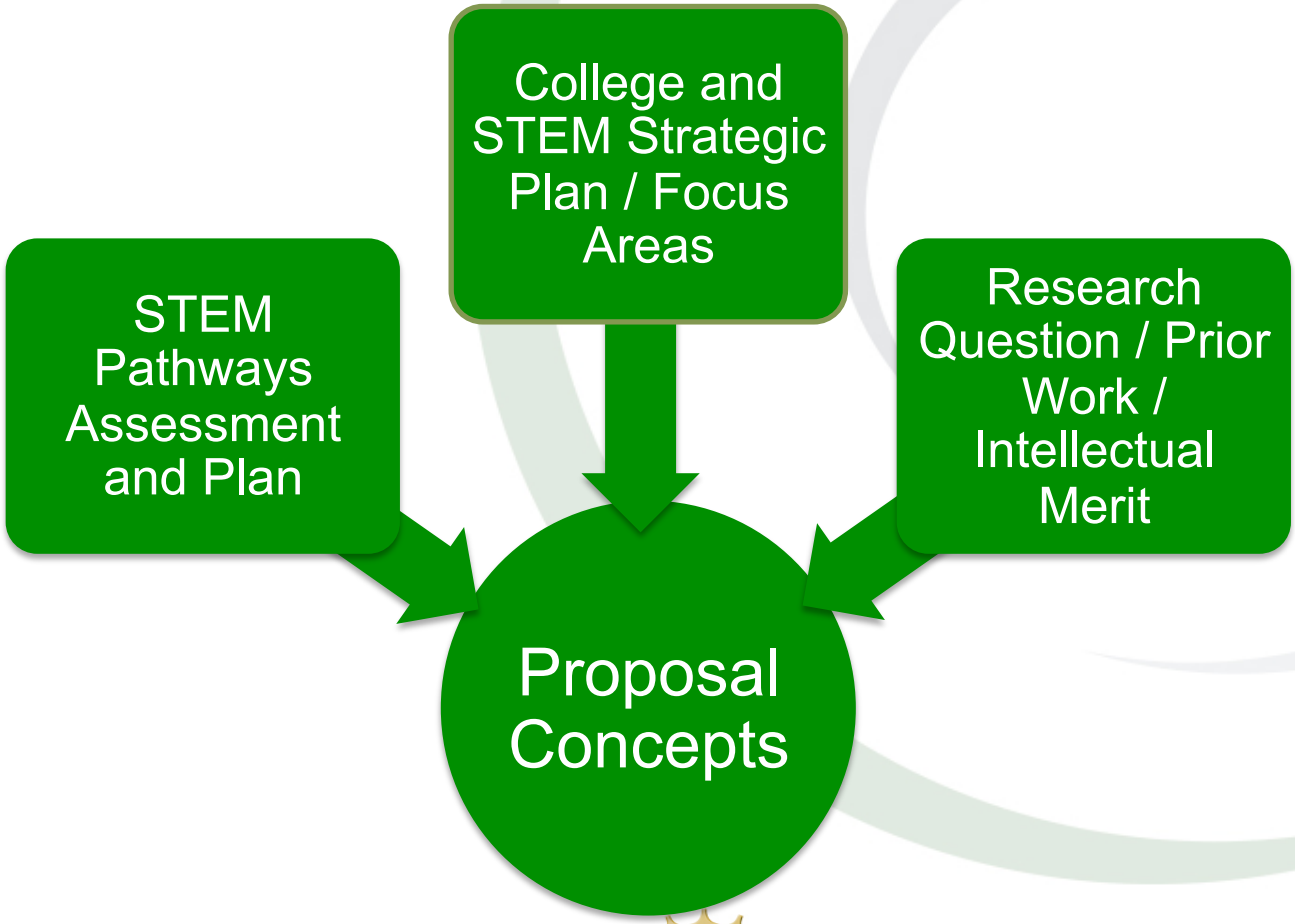
*Secondary Sources: Publications where authors describe the work of others

**General References: Initial Sources that researcher identifies

***Primary Sources: Publications where investigators report the results of their studies

Proposal Concept Development



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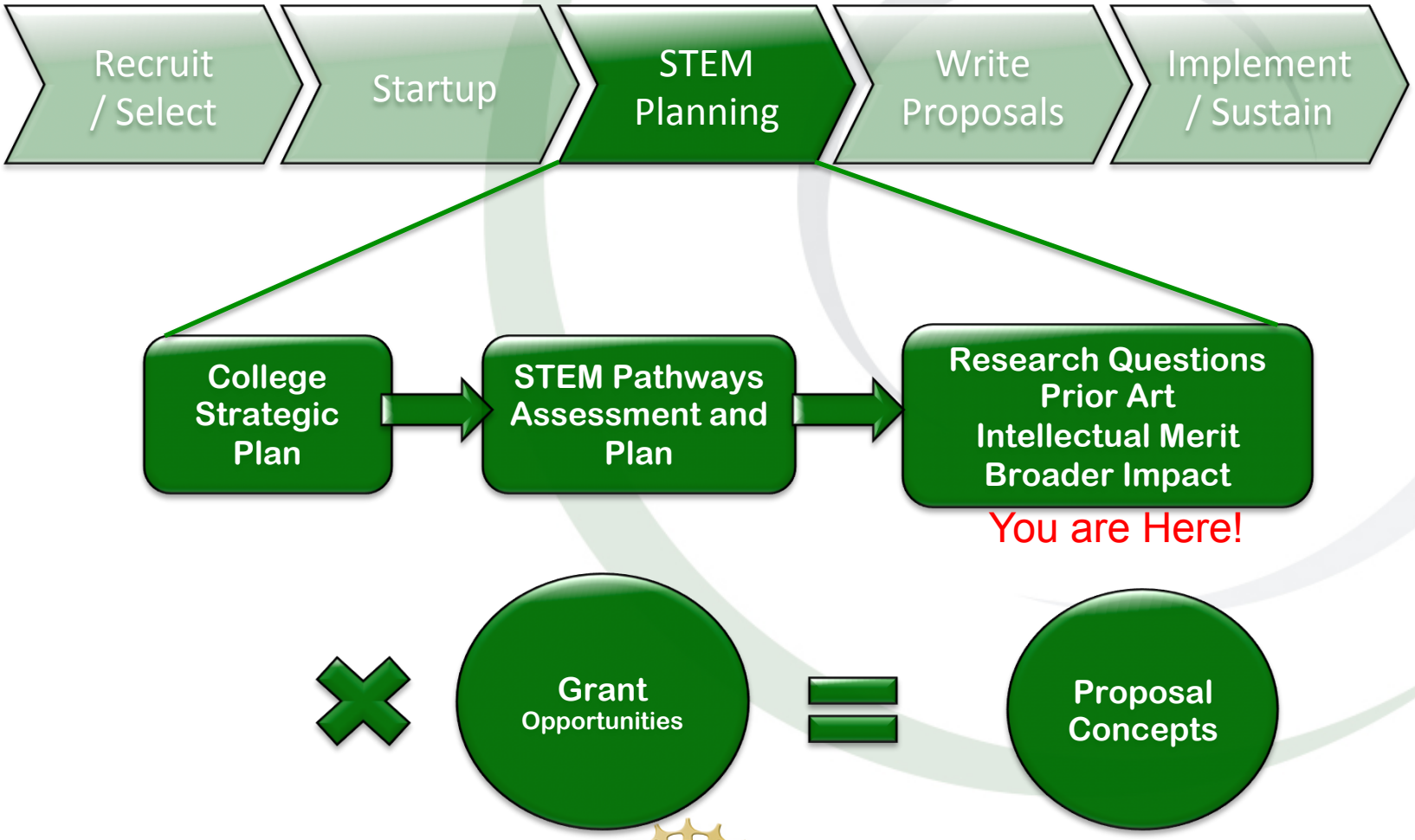
KS Process Context



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Additional Resources

- Common Guildines for Education Research and Development - NSF
- KS Planning Phase Page in KS Group on AZ STEM Network
- KS RSA Training Slides and Recording
- RSA Template
- Your STEM Pathways Plan and Assessment Results in your College's Site Visit Folder
- NSF Toolkit and Webinars
- NSF Slides from KS Kickoff

Resources (cont.)

- Inspiring STEM Learning: Education and Human Resources
  www.nsf.gov/about/congress/reports/ehr_research.pdf
- Perspectives on Broader Impacts
  www.nsf.gov/od/iia/publications/Broader_Impacts.pdf
- Education Research Slideshare ClipBoard

Observations/Highlights - Proposal Development

- Sharing ideas with NSF Program Officer regarding domain of study increases confidence in proposal development team
- “Research Study Approach” (RSA) helped CC-HSIs embrace education research methods and address recognized weaknesses in prior proposals and in the experience of some faculty and grant writers. Using a phased approach in a living RSA document aids concept/proposal development.
- “Red Team Review” emulates NSF Merit Review one month prior to due date

Observations/Highlights - Proposal Development

- Workbook designed to help track proposal activities/components
- Multiple regular meetings with STEM Planning Team serves as Technical Assistance opportunities for proposals
- Prior Cohort serves as role models to newer Cohort by sharing ideas and new concepts during monthly meetings
- Proposal writing improves in subsequent attempts
- ATE Program made adjustments for release time - very helpful as most community college faculty are on overloads - only ATE? Or other programs?