Overview of NSF Education R & D Programs with an Emphasis on the TUES Program

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Important Notes

- Most of the information presented in this workshop represents the presenters’ opinions and not an official NSF position.

- Local facilitators will provide the link to the workshop slides at the completion of the webinar.

- Participants may ask questions by “raising their virtual hand” during a question session. We will call on selected sites and/or enable their microphones so that the questions can be asked. You may also type questions into the chat box.

- Responses will be collected from a few sites at the end of each Exercise. At the start of the Exercise, we will identify these sites in the Chat Box and then call on them one at a time to provide their responses.
Learning must build on prior knowledge
- Some knowledge is correct
- Some knowledge is incorrect – misconceptions

Learning is
- Connecting new knowledge to prior knowledge
- Correcting misconceptions

Learning requires engagement
- Actively recalling prior knowledge
- Sharing new knowledge
- Forming a new understanding
Active & Collaborative Learning

- Effective learning activities
  - Recall prior knowledge – actively, explicitly
  - Connect new concepts to existing ones
  - Challenge and alter misconceptions

- Active & collaborative processes
  - Think individually
  - Share with partner
  - Report to local and virtual groups
  - Learn from program directors’ responses
Facilitator’s Duties

- Coordinate the local activities

- Watch the time
  - Allow for think, share, and report phases
  - Reconvene on time – 1 min warning slide
  - With one minute warning, check Chat Box to see if you will be asked for a response

- Ensure the individual think phase is devoted to thinking and not talking

- Coordinate the asking of questions by local participants and reporting local responses to exercises
Workshop Goal and Expected Outcomes

GOAL:
- Participants should develop a better understanding of NSF undergraduate education R&D programs and the TUES program in particular

OUTCOMES:
- Can identify undergraduate R&D programs and find details on NSF website
- Can describe the kinds of projects that are appropriate for the TUES program
- Can describe the NSF review criteria
- Can describe important features of TUES proposals and effective approaches for addressing them
Activity

NSF R&D Education Programs

- What NSF programs support undergraduate educational R&D?
  - Name the program, and briefly describe the type of projects supported and any special focus
    - Be brief
  - Do not include scholarship programs or those focused on increasing diversity or general participation

- Total time – 2 minutes
  - Identify as many as you can in your local group
- Watch time and reconvene after 2 minutes
Response

NSF Website

- Programs that provide funding that impacts undergraduate students are listed at:

- A more comprehensive list of education R&D programs can be found here:
Response

NSF R&D Undergraduate Education Programs

- EHR/DUE (Division of Undergraduate Education)
  - Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics (TUES),
  - Advanced Technological Education (ATE),
  - Federal Cyber Service: Scholarship for Service (SFS)

- EHR/DRL (Division of Research and Learning)
  - Research and Evaluation on Education in Science and Engr (REESE)

- ENG/EEC (Engineering Education and Centers)
  - Research in Engineering Education (REE)
  - Research Initiation Grants in Engineering Education (RIGEE)

- CISE/CNS (Computer and Network Systems)
  - Computing Education for the 21st Century (CE21)

- Cross-Cutting (Multiple Directorates)
  - Cyberlearning and CAREER
DUE R&D Education Programs

- **TUES** – Focuses on all undergraduates
  - Curriculum development (materials and instructional approaches)
  - Faculty development
  - Assessment and evaluation development and studies
  - Applied education research

- **ATE** – Focuses on technician education and two-year schools
  - Curriculum development
  - Faculty and teacher development
  - Applied education research

- **SFS** – Focuses on cybersecurity
  - Capacity building track includes curriculum and faculty development
Vision for TUES Program: Excellent STEM education for all undergraduate students
What kinds of proposals are appropriate for the TUES Program? Define them in terms of a single goal statement.

- **Total Exercise Time**: 6 min
  - Think individually: ~2 min
  - Share with a partner: ~2 min
  - Report in local group: ~2 min

- Watch time and reconvene after 6 min

- Use THINK time to think – no discussion, Selected local facilitators report to virtual group

- With one minute warning, check Chat Box to see if you will be asked for a response
The TUES program seeks to
  ◦ improve the quality of STEM education for all undergraduate students,
  ◦ especially encourages projects that have the potential to transform undergraduate STEM education,
  ◦ for example, by bringing about widespread adoption of classroom practices that embody understanding of how students learn most effectively
Response

TUES Project Components

- Create Learning Materials and Strategies:
  - Guided by research on teaching and learning
  - Incorporating and inspired by advances within the discipline

- Implement New Instructional Strategies:
  - Which contribute to understanding on how existing strategies
    - Can be widely adopted
    - Are transferred to diverse settings
    - Impact student learning in diverse settings

- Develop Faculty Expertise:
  - Enable faculty to acquire new knowledge and skills in order to revise their curricula and teaching practices
  - Involve a diverse group of faculty
Assess and Evaluate Student Achievement:
- Develop and disseminate valid and reliable tests of STEM knowledge
- Collect, synthesize, and interpret information about student understanding, reasoning, practical skills, interests, attitudes or other valued outcomes

Conduct Research on Undergraduate STEM Education to Explore How:
- Effective teaching strategies and curricula enhance learning and attitudes,
- Widespread practices have diffused through the community
- Faculty and programs implement changes in their curriculum
Project Types

- **Type 1**
  - Total budget up to $200,000 for 2 to 3 years
  - $250,000 when 4-year and 2-year schools collaborate

- **Type 2**
  - Total budget up to $600,000 for 2 to 4 years

- **Type 3**
  - Budget negotiable -- not to exceed $5,000,000 over 5 years

- **Central Resource Projects**
  - Small focused workshop projects—budget negotiable—up to $100,000 for 1 to 2 years
  - Large scale projects—budget negotiable—$300,000 to 3,000,000 for 3 to 5 years
Examples of Type 1 Projects

- Uses a new instructional approach based on how students learn
- Introduces content from current research
- Integrates new instrumentation that demonstrably improves student learning
- Provide the needed courses for a seamless 2-4 year transfer
- Integrates current science and pedagogy into the teacher preparation curriculum
- Novel methods for faculty professional development
- Develops an instrument to assess students’ knowledge or attitude
- Understand factors affecting how students learn particular content or skills
Examples of Type 2 Projects

- ... at several institutions ...
- ... involving several diverse partnerships ...
- ... part of a widespread beta–testing effort ...
- faculty in several diverse institutions ...
- disseminate proven ...
- ... converts an effective ... to improve accessibility and sustainability
Examples of Type 3 Projects

- ... involves a regional or national effort to disseminate proven materials or pedagogies
- ... develops a self-sustaining model for faculty professional development ...
- ... involving a wide range of diverse institutions ...
- ... systematically compares the efficacy and efficiency of ...
Examples of Central Resource Projects

- Organize and implement meetings of ...
- Conduct targeted research or evaluation studies of ...
- Develop an approach for describing or characterizing the portfolio of ...
- Workshops that increase understanding of project evaluations, broadening participation, utilizing cyberinfrastructure, and engaging pedagogies of ...

... TUES projects!

Other examples can be found in the solicitation
Proposal Deadlines

- For **Type 1** -- states or territories beginning with A through M.
  - May 28, 2012
- For **Type 1** -- states or territories beginning with N through W.
  - May 29, 2012
- For **Type 2 and 3** and **Central Resource Projects**
  - January 13, 2012
  - January 14, 2013
- **Central Resource Project proposals for small focused workshops**
  - Submitted at any time after consulting with a program officer
Activity

TUES Proposal Review Criteria

- What review criteria are used in reviewing TUES proposals?
  - Total time — 2 min
    - Discuss in local group
  - Watch time and reconvene after 2 min
Response

TUES Proposal Review Criteria

- What review criteria do you think should be used in reviewing TUES proposals?

- Every proposal submitted to NSF is reviewed on two criteria:
  - Intellectual Merit
  - Broader Impact
Activity

TUES Proposal Review Criteria

- What are some of the questions or factors that reviewers use in determining
  - Intellectual merit?
  - Broader impacts?

- Total Exercise Time 6 min
  - Think individually ~2 min
  - Share with a partner ~2 min
  - Report in local group ~2 min

- Watch time and reconvene after 6 min

- Use THINK time to think – no discussion; Selected local facilitators report to virtual group

- With one minute warning, check Chat Box to see if you will be asked for a response
Response
NSF Suggested Questions for Intellectual Merit

- Will the project
  - Include activities important in advancing knowledge?
  - Involve qualified proposer(s)?
  - Contain creative, original, and potentially transformative concepts?
  - Have a well conceived and organized plan?
  - Include sufficient access to resources?
Will the project

- Produce one or more of the following:
  - Exemplary materials, processes, or models that enhance student learning and can be adopted by other sites
  - Important findings related to student learning?
- Build on existing knowledge about STEM education?
- Have explicit and appropriate expected measurable outcomes integrated into an evaluation plan?
- Include an evaluation effort that is likely to produce useful information?
- Institutionalize the approach at the investigator's college or university as appropriate for the Type
Response

NSF Suggested Questions for Broader Impacts

- Will the project
  - Advance discovery - promote teaching & learning?
  - Broaden participation of underrepresented groups?
  - Enhance the infrastructure?
  - Include broad dissemination?
  - Benefit society?
Response

TUES Suggested Questions for Broader Impacts

Will the project

- Involve a significant effort to facilitate adaptation at other sites?
- Contribute to the understanding of STEM education?
- Help build and diversify the STEM education community?
- Have a broad impact on STEM education in an area of recognized need or opportunity?
- Have the potential to contribute to a paradigm shift in undergraduate STEM education?
Questions

“Hold-up your virtual hand” and you will be called upon after we unmute your mike. You may also type questions into your chat box.
BREAK

15 min

Reconvene at 2:15 Eastern Time
One Minute
How do you convince a reader that your project will
- Build on existing knowledge about STEM education
- Contribute to the understanding of STEM education
- Have a broad impact on STEM education in an area of recognized need or opportunity

What should you include in the proposal’s rationale, background, and justification sections?

- **Total Exercise Time** 6 min
  - Think individually ~2 min
  - Share with a partner ~2 min
  - Report in local group ~2 min
- Watch time and reconvene after 6 min
Response
Rationale Background, and Justification

- **Prior work**
  - By others -- Referenced to the literature
  - By applicant – prior results or preliminary data

- **Relevant theory**
  - Referenced to the literature (*How People Learn*)

- **Importance of the problem**
  - Incorporates new disciplinary knowledge
  - Addresses an emerging area or known problem
  - Meets an industry need

- **Potential impact of the work**
  - Number of students
  - Transportable to a large number of institutions
  - Serves as model for other areas
How do you convince a reader that your project
- Can be adopted by other sites
- Contains a significant effort to facilitate adaptation at other sites
- Has the potential to contribute to a paradigm shift in undergraduate STEM education

What is your dissemination plan?

- Total Exercise Time 6 min
  - Think individually ~2 min
  - Share with a partner ~2 min
  - Report in local group ~2 min
- Watch time and reconvene after 6 min
- Use THINK time to think – no discussion, Selected local facilitators report to virtual group
Response
Dissemination Strategies

- Build in transportability
  - Develop an outward focus – how will approach work elsewhere
  - Develop a product attitude instead of a course focus

- Use active promotion approaches
  - In addition to standard approaches (websites, conference papers, and journal articles)
  - Add broader approaches
    - Workshops and webinars
    - Specialty websites and list servers – e.g., Connexions site
    - Commercialization of products

- Target specific audiences
  - Engage a few faculty members at other institutions
    - To periodically critique, advise, adapt and adopt materials
Activity

Goals, Outcomes, and Evaluation

- How do you convince a reader that your proposal has
  - Explicit and appropriate expected measurable outcomes
  - An evaluation plan that is likely to produce useful information
- What are the characteristics of good goals and outcomes?
- What should be addressed in an evaluation plan?

- Total Exercise Time 6 min
  - Think individually ~2 min
  - Share with a partner ~2 min
  - Report in local group ~2 min
- Watch time and reconvene after 6 min
- With one minute warning, check Chat Box to see if you will be asked for a response
**Response**

**Goals and Outcomes**

- **Define goals** – ambition or intention
  - Overarching statements of project intention
  - Two types of goals
    - Project management goals – tasks or activities
    - Student behavior goals – knowledge, skills or attitudes

- **Define expected measurable outcomes** – observable changes in behavior
  - How will achieving your “intention” change behavior?
  - Thought experiment — distinguish students that have developed the desired knowledge, skill, or attitude from those that have not

- **Make goals and outcomes consistent** with rationale and planned activities
Response

Evaluation Plan

- Evaluator expertise and independence
- Evaluation questions
  - Derived from the expected outcomes
- Methods
  - Tools (instruments) and protocols (timing, etc)
  - Data analysis and interpretation
- Confounding factors – alternate explanations
  - Approaches for minimizing their impact
- Formative and Summative Evaluation
Activity

Broader Impact & Diversity

How do you convince a reader that your project helps build and diversify the STEM education community?

- Total Exercise Time 6 min
  - Think individually ~2 min
  - Share with a partner ~2 min
  - Report in local group ~2 min

- Watch time and reconvene after 6 min
- Use THINK time to think – no discussion, selected local facilitators report to virtual group
- With one minute warning, check Chat Box to see if you will be asked for a response
Response

Building and Diversifying the Community

- **Describe** the planned activities
- **Explain** the rational behind these activities
- Identify expected **measurable outcomes**
- Include evaluation strategies to **monitor progress**
Activity
Final Reflection

- **What ideas in this presentation surprised you?**

  - Total time 4 min
    - Think individually ~2 min
    - Report in local group ~2 min
  - Watch time and reconvene after 4 min
  - Use THINK time to think – no discussion, selected local facilitators report to virtual group
  - With one minute warning, check Chat Box to see if you will be asked for a response
Questions

“Hold-up your virtual hand” and you will be called upon after we unmute your mike. You may also type questions into your chat box.
Thanks for your participation!

- To download a copy of the presentation go to: http://www.nsflsu.com

- Please complete the assessment survey go to: http://www.nsflsu.com