Overview of TUES Program
and
Developing the Educational Plan

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Outline

• Overview of TUES Program
• Developing the Educational Plan
Overview

- Program Title
- Program Description
- Our CCLI Project
- Developing a Type 1 Proposal
Program Title

Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics (TUES) Course, Curriculum, and Laboratory Improvement (CCLI)
Types of Projects

- **Type 1 Projects**: Total budget may not exceed $200,000 ($250,000 when four-year colleges and universities collaborate with two-year colleges) for 2 to 3 years.

- **Type 2 Projects**: Total budget may not exceed $600,000 for 2 to 4 years.

- **Type 3 Projects**: Budget negotiable, may not exceed $5,000,000 over 5 years.

- **TUES Central Resource Projects**: Budget negotiable, depending on the scope and scale of the activity but the total budget may not exceed $3,000,000.
Examples of Type 1 Projects (1)

- A project that develops materials that use a new instructional approach based on the current understanding of how students learn.
- A project that introduces content from current research into an existing course.
- A project that integrates new instrumentation or equipment into undergraduate laboratories or field work in a way that demonstrably improves student learning.
- A collaborative project between faculty from two-year and four-year schools that develops a model to provide the needed courses for a seamless transfer in an efficient way.
Examples of Type 1 Projects (2)

- A pilot project that explores the practical aspects of using remote laboratories or instruction among several institutions.
- A pilot project that integrates current science and pedagogy into the teacher preparation curriculum.
- A pilot study to explore Internet-based approaches for faculty professional development.
- A project that develops an instrument to assess students’ knowledge in a particular area, their abilities with certain processes, or their attitude about some aspect of STEM.
- A pilot study to begin understanding how various factors affect how students learn particular content or skills.
Examples of Type 2 Projects (1)

- A project that develops material for a sequence of courses that vertically integrates a conceptual or pedagogical approach at several institutions.

- A project involving several diverse partnerships between community colleges and four-year schools to develop robust models for providing community college courses needed for a true two-plus-two transfer program.

- A project that uses faculty professional development as a part of a widespread beta–testing effort with faculty in several diverse institutions in order to disseminate proven, innovative instructional material or approaches.
Examples of Type 2 Projects (2)

- A project that converts an effective, in-person faculty professional development approach to an Internet-based or blended approach in order to improve accessibility and sustainability.

- A project involving several diverse institutions that uses an existing instrument to assess students’ knowledge in a particular area or their abilities with certain processes.

- A study involving several diverse institutions to identify what factors and characteristics effect how faculty members and departments adopt innovative approaches.
Examples of Type 3 Projects (1)

- A project that involves a **regional or national** effort to **disseminate** proven materials or pedagogies.
- A project that develops a **self-sustaining model** for faculty professional development that introduces new faculty to a field or provides retraining for experienced faculty.
- A **national or regional** level project involving a **wide range of diverse institutions** that uses an existing assessment instrument to develop a database on students’ knowledge in a particular area or their abilities with certain processes.
Examples of Type 3 Projects (2)

- A study involving a **broad range of diverse institutions** that explores how various factors affect how students learn particular content or skills.
- A study involving a **broad range of diverse institutions** that systematically compares the efficacy and efficiency of several instructional methodologies such as hands-on, remote, and virtual laboratories.
Examples of Central Resource Projects (1)

- Projects that organize and implement meetings of Principal Investigators of projects funded by the TUES program and its predecessors. This includes large scale meetings of all grantees or smaller meetings of interest groups within the program. This activity should include publication of findings from meetings. (AAAS – 2011, 2013)

- Projects that conduct targeted research or evaluation studies in undergraduate STEM education addressed by CCLI and TUES projects, the impact of CCLI and TUES supported activities or a subset of awards, or those of TUES's predecessor programs. Proposals should state questions to be addressed, describe study design and methodology, and draw on relevant literature.
Examples of Central Resource Projects (2)

- Projects that develop an approach for describing or characterizing the portfolio of TUES and other predecessor programs. Proposals should describe strategies for organizing the characterization, for collecting the information, and for reporting and presenting the results. Proposals applying new techniques for presenting large data sets (quantitative and qualitative) are encouraged.

- Projects that provide workshops that increase potential and current PIs’ understanding of various topics such as conducting project evaluations, broadening participation, utilizing cyberinfrastructure, and incorporating engaging pedagogies.
Examples of Central Resource Projects (3)

- Projects that provide leadership and implementation in seeing to it that development of the CCLI and TUES community of practice is supported by current cyber tools for communication and collection of resources. Systems should integrate with the National STEM Distributed Learning (NSDL) resources as described in section V-A. A project devoted to this goal may utilize NSDL resources by establishing effective interchanges between CCLI and TUES awardees and the existing NSDL pathways projects, or it may establish a separate entity with connection to the NSDL resources.
Project Components (1)

- Creating Learning Materials and Strategies
  - Guided by research on teaching and learning
  - Incorporate and be inspired by advances within the discipline

- Implementing New Instructional Strategies
  - Contribute to understanding on how existing strategies
    - Can be widely adopted
    - Are transferred to diverse settings
    - Impact student learning in diverse settings
Project Components (2)

- Developing 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

- Assessing and Evaluating 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
Project Components (3)

- Conducting Research on Undergraduate STEM Education:
  - 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

Even a Level 2 or a Level 3 proposal will not (likely) address all of these components!
IMPORTANT PROJECT FEATURES

• Quality, Relevance, and Impact
• Student Focus
• Use of Knowledge about STEM Education
• Contribution to Knowledge about STEM Education
• STEM Education Community-Building
• Sustainability
• Expected Measurable Outcomes
• Project Evaluation
Our NSF Grant CDA 9115281

- Parallel Computation in the Undergraduate Computer Science Curriculum
- PI and Project Director: Ratan Guha,
- CoPIs: N. Deo, T. Frederick, C.E. Hughes, A. Mukherjee
Our NSF Grant EIA 0086251

- Introducing Fundamental Concepts and Evaluation Methods for Distributed Systems and Applications in Computer Science Curriculum
- PI: Ratan Guha
- CoPIs: Mostafa Bassiouni and Erol Gelenbe
- 9/15/2000-10/31/2005
Our CCLI Proposal

- Undergraduate Computer Security Course Enhancement
- NSF Grant No. 0837320
- PI: Ratan Guha
- CoPI: Mostafa Bassiouni
- Others: Arup Guha and Bonnie Swan
- May 2009 – April 2012
Expected outcomes of the project

- The development of **several learning modules** covering the various aspects of modern computer security and information assurance. Each module will be designed so that it can be easily adapted later to develop faculty enhancement workshops for a future follow-on project.

- The development of a set of **laboratory exercises/projects**, pool of questions and associated materials to enhance the learning experiences of students.

- The development of a detailed description of how best to organize and use the developed learning modules, **lab materials and assignments** to cover the required topics of each of the following four courses: CIS 3360 (Security in Computing), CIS 3362 (Cryptography), CIS 4361 (Secure Operating System and Administration), and CNT 4403 (Network Security).

- The **development and delivery of online materials**.

- The development of a description of the results and the techniques used to perform assessment of the effectiveness of the developed learning materials (both online and face-to-face).
The Modular Curricular Approach

- Our rationale for developing the curriculum modules is that the delivery system of technical materials should depend on the type and the background of the targeted audience.

- The modules are then synthesized suitably to develop four courses in the area of information security and protection. These courses are:
  - Security in Computing (CIS 3360)
  - Cryptography and Information Security (CIS 3362)
  - Secure Operating Systems and Administration (CIS 4361)
  - Network Security and Privacy (CNT 4403)
Synthesis of courses from the curricular modules
Security in Computing

CIS 3360
Security in Computing

Background Modules

Cryptography

Security Concepts
Attacks, Defense

Laws and Ethics
for Security

Operating System, Database, Network Security
Network Security

CNT 4403
Network Security

Background Modules

Cryptography

Privacy

Security in Computer Networks and Secure Protocols
Important Components in a Proposal

- Intellectual Merit
- Broader Impacts
- Data Management Plan (New)

  Proposals submitted or due on or after January 18, 2011, must include a supplementary document of no more than two pages labeled “Data Management Plan”
Data Management Plan

- Data Management Plan: The PAPPG contains a clarification of NSF's long-standing data policy. All proposals must describe plans for data management and sharing of the products of research, or assert the absence of the need for such plans.
- FastLane will not permit submission of a proposal that is missing a Data Management Plan.
- The Data Management Plan will be reviewed as part of the intellectual merit or broader impacts of the proposal, or both, as appropriate. Links to data management requirements and plans relevant to specific Directorates, Offices, Divisions, Programs, or other NSF units are available on the NSF website at: http://www.nsf.gov/bfa/dias/policy/dmp.jsp. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.
Important Components in a Proposal (2)

- Background: Relevant experience and availability of current facilities
- Project Goals and Significance
- Expected Outcomes
- Project Activities
  - Give some well thought out activities
TUES Suggested Questions for Intellectual Merit

Will the project

- Produce exemplary material, processes, or models that enhance student learning and can be adapted easily by other sites?
- Provide important findings related to student learning?
- Build on existing knowledge about STEM education?
- Have expected measurable outcomes integrated into an evaluation plan?
- Produce useful information from evaluation effort?
- Provide appropriate plans for institutionalizing the approach at the investigator’s university?
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?
Intellectual Merit and Broader Impacts Plan

Include strategy to achieve impact
- Have a well-defined set of expected outcomes
- Make results meaningful and valuable
- Make consistent with technical project tasks
- Have detailed plan for activities
- Provide rational to justify activities
- Include evaluation of impacts
- Have a well stated relationship to the audience or audiences