Attracting funding from the National Science Foundation (NSF)

"The Good , the Bad, and the Ugly"

Florencio "Eloy" Hernandez

Professor and Associate Dean of Research & Innovation

College of Community Innovation and Education

University of Central Florida

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National Science Foundation (NSF)

NSF Director
Dr. Sethuraman Panchanathan

https://www.nsf.gov/about/how.jsp

UNITED STATES
National Science Foundation
FY 2020 Performance and Financial Highlights

Mission: To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes.

Vision: A Nation that is the global leader in research and innovation.

Who We Are and What We Do

- Established by Congress in 1950 as an independent federal agency to promote American science and engineering (S&E).
- The National Science Foundation (NSF) is the only federal agency that invests in fundamental, basic research and education across the full spectrum of science, technology, engineering, and mathematics (STEM) disciplines.
- NSF invests in basic research that sets the stage for transformative breakthroughs and leads to new ways of thinking about scientific, economic, and sociotechnical challenges facing the Nation and the world.
- NSF supports research and workforce development programs that help drive future economic growth and enhance our Nation's security and global competitiveness.
- NSF funds advanced instrumentation and facilities, Arctic and Antarctic research and operations, cooperative research between universities and industry, and U.S. participation in international scientific efforts.

At A Glance

$8.4 billion	FY 2020 Appropriations (does not include mandatory accounts)
1,421	NSF Employees (Full Time Equivalents in FY 2020)
1,900	Colleges, universities, and other institutions receiving NSF funding in FY 2020
12,200	Competitive awards funded in FY 2020
28%	Funding rate in FY 2020
313,000	Estimated number of people NSF supported directly in FY 2020 (researchers, postdoctoral fellows, trainees, teachers, and students)

NSF-led AI Research Institutes: Pushing Forward the Frontiers of Artificial Intelligence

Types of NSF proposals

1. Program Solicitations/Announcements
2. Unsolicited Proposals
3. Cross-Directorate Programs (CAREER)
4. Small Grants (Exploratory Research or Severe Urgency)
5. Supplements (Including REU and RET)

1. Whether the proposal is:

- A collaborative proposal from one organization (see GPG Chapter II.D.5.a)
- A collaborative proposal from multiple organizations (see GPG Chapter II.D.5.b)
- Not a collaborative proposal.

2. The type of proposal being developed:

- RAPID (see GPG Chapter II.D.1)
- EAGER (see GPG Chapter II.D.2)
- Research - other than RAPID or EAGER (see GPG Chapter II)
- Ideas Lab (see GPG Chapter II.D.3)
- Equipment (see GPG Chapter II.D.6)
- Conference (see GPG Chapter II.D.9)
- International Travel (see GPG Chapter II.D.10)
- Fellowship (see relevant funding opportunity)
- Facility/Center (see relevant funding opportunity).

https://www.nsf.gov/pubs/policydocs/pappguide/nsf15001/gpg_print.pdf

Directorates/Divisions

1. Biological Sciences (BIO)
2. Computer & Information Sciences & Engineering (CISE)
3. **Education & Human Resources (EHR)**
4. Engineering (ENG)
5. Geosciences (GEO)
6. Integrative Activities (OIA)
7. International Science and Engineering (OISE)
8. Mathematical and Physical Sciences (MPS)
9. **Social, Behavioral & Economic Sciences (SBE)**

- Graduate Education (DGE)
- Research on Learning in Formal and Informal Settings (DRL)
- Undergraduate Education (DUE)
- Human Resource Development (HRD)

- Behavioral and Cognitive Sciences (BCS)
- National Center for Science and Engineering Statistics (NCSES)
- Social and Economic Sciences (SES)
- SBE Office of Multidisciplinary Activities (SMA)

https://www.nsf.gov/pubs/policydocs/pappguide/nsf15001/gpg_print.pdf

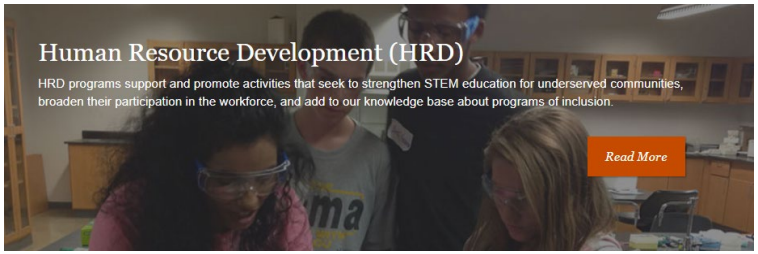
EHR Divisions & Offices

The mission of EHR is to achieve excellence in U.S. science, technology, engineering and mathematics (STEM) education at all levels and in all settings (both formal and informal) in order to support the development of a diverse and well-prepared workforce of scientists, technicians, engineers, mathematicians and educators and a well-informed citizenry that have access to the ideas and tools of science and engineering. The purpose of these activities is to enhance the quality of life of all citizens and the health, prosperity, welfare and security of the nation.

https://www.nsf.gov/ehr/about.jsp

- Division of Graduate Education (DGE)
- Division of Research on Learning in Formal and Informal Settings (DRL)
- Division of Undergraduate Education (DUE)
- Division of Human Resource Development (HRD)

SBE Programs



- Advanced Technological Education (ATE)
- Advancing Informal STEM Learning (AISL)
- Computer Science for All (CSforAll: Research and RPPs)
  Crosscutting
- Discovery Research PreK-12 (DRK-12)
- EHR Core Research (ECR): Building Capacity in STEM Education Research (ECR: BCSER)
- EHR Core Research: Production Engineering Education and Research (ECR)
- Innovative Technology Experiences for Students and Teachers (ITEST)
- Smart and Connected Communities (S&CC)
- STEM + Computing K-12 Education (STEM+C)

SBE Divisions

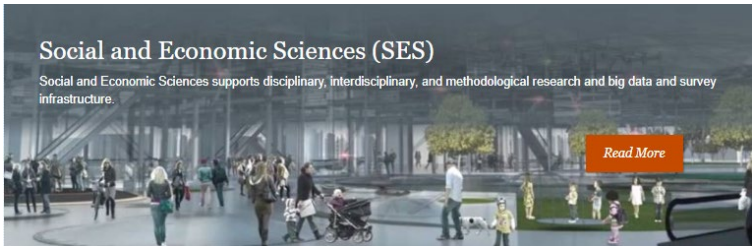
NSF's Directorate for Social, Behavioral, and Economic (SBE) Sciences supports basic research on people and society. The SBE sciences focus on human behavior and social organizations and how social, economic, political, cultural, and environmental forces affect the lives of people from birth to old age and how people in turn shape those forces.

Through its various core disciplinary and interdisciplinary programs, as well as contributions to cross-directorate NSF investments, SBE supports approximately 5,000 scientists, educators, and students in a typical year.

https://www.nsf.gov/dir/index.jsp?org=SBE

- Behavioral and Cognitive Sciences (BCS)
- National Center for Science and Engineering Statistics (NCSES)
- Social and Economic Sciences (SES)
- SBE Office of Multidisciplinary Activities (SMA)

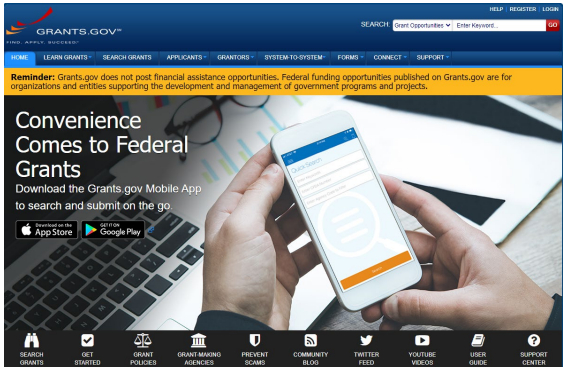
SBE Divisions & Offices



NCSES

- Accountable Institutions and Behavior (AIB)
- Decision, Risk and Management Sciences (DRMS)
- Designing Accountable Software Systems (DASS)
- Designing Synthetic Cells Beyond the Bounds of Evolution (Designer Cells)
- Economics
- General Social Survey (GSS) Competition
- Human Networks and Data Science (HNDS)
- Law & Science (LS)
- Methodology, Measurement, and Statistics (MMS)
- Mid-Career Advancement (MCA)CCrosscutting
- Panel Study of Income Dynamics Competition
- Restricted-Access Research Data Centers (RDCs)
- SBE Science of Broadening Participation (SBE SBP)
- Science and Technology Studies (STS)
- Science of Organizations (SoO)
- Secure and Trustworthy Cyberspace (SaTC)CCrosscutting
- Secure and Trustworthy Cyberspace Frontiers (SaTC Frontiers)
- Security and Preparedness (SAP)
- Smart and Connected Communities (S&CC)
- Sociology
- Stimulating Collaborative Advances Leveraging Expertise in the Mathematical and Scientific Foundations of Deep Learning (SCALE MoDL)
- The NSF-Census Research Network (NCRN)

Merit Review Process



PHASE I

PROPOSAL PREPARATION AND SUBMISSION
90 DAYS

1 OPPORTUNITY ANNOUNCED → 2 PROPOSAL SUBMITTED → 3 PROPOSAL RECEIVED

PHASE II

PROPOSAL REVIEW AND PROCESSING
6 MONTHS

4 REVIEWERS SELECTED → 5 PEER REVIEW → 6 PROGRAM OFFICER RECOMMENDATION → 7 DIVISION DIRECTOR REVIEW

PHASE III

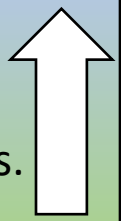
AWARD PROCESSING
30 DAYS

8 BUSINESS REVIEW → 9 AWARD FINALIZED

https://www.nsf.gov/bfa/dias/policy/merit_review/
https://www.nsf.gov/funding/index.jsp
https://www.fastlane.nsf.gov/
https://www.grants.gov/

Panel Recommendations

High Priority	Medium Priority	Low Priority
Most Compelling Projects	***Innovative Projects***	***Fundamentally Flawed Projects***
Minimal flaws, enthusiastic panelist and reviewer endorsement	Only nominally weakened by surmountable flaws.	Panel feels the project should not be funded even if unlimited resources were available.



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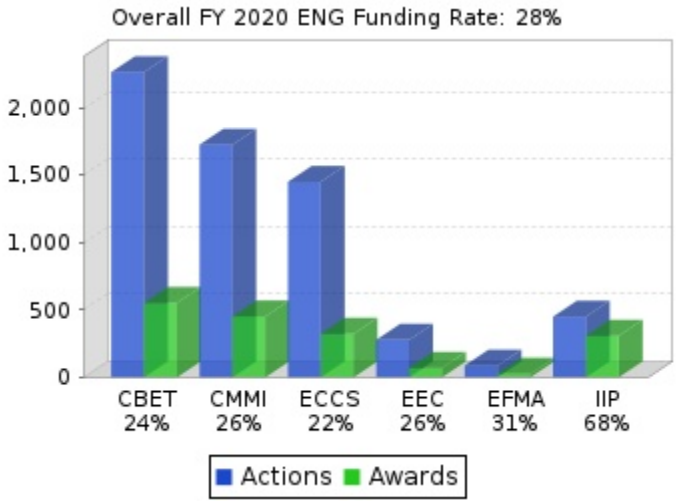
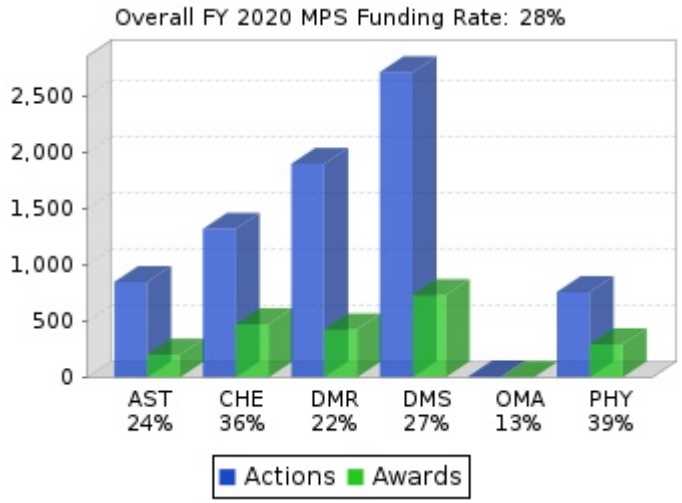
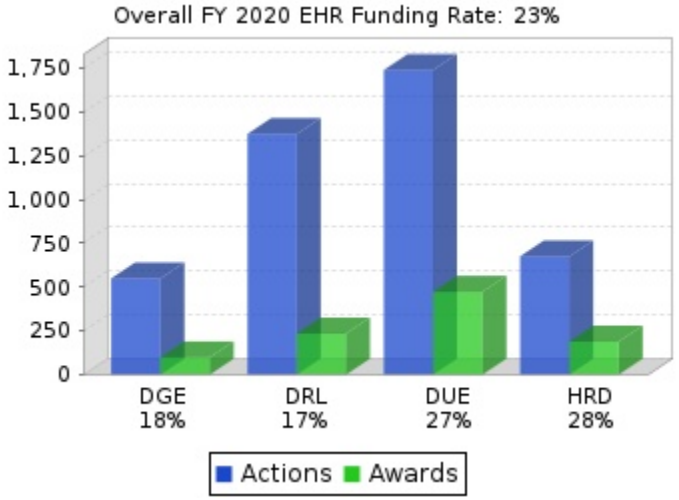
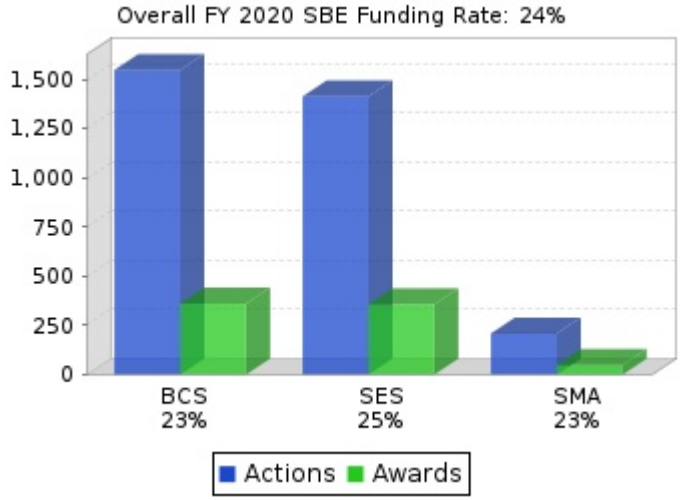
Success Rate/Division









Merit Review Criteria

When evaluating NSF proposals, reviewers should consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits would accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers are asked to evaluate all proposals against two criteria:

Intellectual Merit: The intellectual Merit criterion encompasses the potential to advance knowledge

Broader Impacts: The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

https://www.nsf.gov/pubs/policydocs/pappg18_1/pappg_3.jsp#IIIA2a

Intellectual Merit

"Advance knowledge and understanding within its own field or across different fields."

1. How important is the proposed activity to **advancing knowledge and understanding** within its own field or across different fields?
2. How **well qualified** is the proposer to conduct the project?
3. To what extent does the proposed activity explore **creative and original concepts**?
4. How **well conceived and organized** is the proposed activity?
5. Is there sufficient **access to necessary resources?**

Broader Impacts

"Benefit society or advance desired societal outcomes."

1. How well does the activity advance discovery and understanding while **promoting teaching, training and learning**?
2. How well does the proposed activity **broaden the participation of underrepresented groups**?
3. To what extent will it **enhance the infrastructure fo research and education**, such as facilities, instrumentation, networks and partnerships?
4. Will the results be **disseminated broadly to enhance scientific and technological understanding**?
5. What may be the **benefits** of the proposed activity **to society**?

20 Tips for Success

1. Read successful proposals.
2. Find a mentor with experience attracting funding from the NSF.
3. Develop a couple of hypothesis-driven ideas (Think outside of the box).
4. Build credibility (Peer-reviewed publications and small grants).
5. Expand your network (Attend conferences and promote your ideas among colleagues).
6. Match your idea with a program (Be open-minded to adapt).
7. Carefully read the solicitation (Address all points).
8. Check what has recently been awarded (Check the NSF program's website).
9. Volunteer to serve as a project reviewer and panelist (Learn from within).
10. Build a team through collaboration to strengthen your proposal (When needed).
11. Communicate your intention to apply to your ADR and internal office of research.
12. Prepare your elevator speech (Work in a pitch-circle and accept criticism/feedback).
13. Contact Program Officer and present your ideas (Their feedback is critical – Make an appointment via e-mail, they are busy).
14. Read the proposal guidelines and determine the submission deadline.
15. Start working on your summary page (Start with the why - this is critical!).
16. Develop the proposal's IM and BI (Integrate research and education).
17. Develop your proposal description (Focus on innovation, transformation, and impact).
18. Create your budget and budget justification, timeline, and develop a data management plan, postdoc mentoring plan, facilities, and others as needed.
19. Seek pre-peer-reviews to proofread and criticize your proposal before submission.
20. Never give up (Read reviews, address issues, and re-submit).

Project Reviewer

Benefits to You as a Reviewer

In addition to providing a great service to NSF and the science and engineering community, reviewers benefit from reviewing and serving on panels. For example, reviewers gain first hand knowledge of the peer review process; learn about common problems with proposals; discover strategies to write strong proposals; and, through serving on a panel, meet colleagues and NSF program officers managing programs related to your interests.

How to Become a Reviewer

To become an NSF reviewer, send an e-mail to the NSF program officer(s) of the program(s) that fits your expertise. Introduce yourself and identify your areas of expertise, and let them know that you are interested in becoming a peer reviewer. It is most helpful if you also attach a 2-page CV with current contact information. We also encourage you to share this request with other colleagues who might be interested in serving as NSF reviewers. NSF welcomes qualified reviewers from the academic, industrial, and government sectors.

If you are selected as a reviewer, NSF will ask you to provide some demographic information on a voluntary basis[1]. Although submission of demographic information by reviewers is voluntary-and there are no adverse consequences if it is not provided-reviewers are strongly encouraged to provide this information to NSF. These data are used in the design, implementation, and monitoring of NSF efforts to increase the participation of various groups in science and engineering.

Contact NSF Now

Please take a few minutes now to contact NSF. If you need to find the appropriate NSF Program Officer to contact, just go to the NSF Website: www.nsf.gov. Select the Quick Links tab at the top of the home page. This will take you to the selected home page. The "Contact US" column provides contact information for Program Officers and the programs they manage. You can then send the Program Officer an email with the information indicated above in the paragraph on "How to Become a Reviewer."

[1]Collection of personal information is authorized by the NSF Act of 1950, as amended. The data are protected by the Privacy Act and Public Burden Statements (see http://www.usdoj.gov/oip/privstat.htm), which means NSF will not give this information to anyone outside NSF, unless legally required, or specifically authorized by law.

https://www.nsf.gov/bfa/dias/policy/merit_review/reviewer.jsp

Competitive Proposal

- Original ideas and hypothesis driven
- Concise, focused project plan, and cost effective
- PIs knowledge and experience in the discipline
- Clear description of the methodology
- Realistic amount of work
- Sufficient details
- Provide preliminary results as evidence

Inquiries → Hypotheses → Methodology → Expected outcomes → Timeline → Budget

- Use plain and simple English
- Do not include extra stuff
- Put specifics in the Methods section
- Use tables, figures, and flow charts to save words
- Make it visually appealing

Preparation and Submission

Methodology, Measurement, and Statistics (MMS)

CONTACTS

Name	Email	Phone	Room
Cheryl L. Eavey	ceavey@nsf.gov	(703) 292-7269	

PROGRAM GUIDELINES

Solicitation 19-575

Important Information for Proposers

A revised version of the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 20-1), is effective for proposals submitted, or due, on or after June 1, 2020. Please be advised that, depending on the specified due date, the guidelines contained in NSF 20-1 may apply to proposals submitted in response to this funding opportunity.

DUE DATES

Full Proposal Deadline Date

August 26, 2021

Last Thursday in August, Annually Thereafter

January 27, 2022

Last Thursday in January, Annually Thereafter

Example of Summary Page

Freshmen Undertake Networking in Science, Technology, Engineering and Mathematics (FUN-STEM)

Project objectives: The main goal of this *Level I - EHR Core Research Proposal* is to develop a unique multiuser technological platform that simultaneously brings tutoring and promote STEM careers among college freshmen students where, when and how they want it. *Our specific objectives are:* i) To combine all social networking sites (SNS), email and text messages to assist students according to their individual preferences; ii) to provide a "24/7" consulting service when they need it most; iii) to motivate and engage students through online tutoring; and, iv) to leverage the reaching capability of this platform to effectively promote STEM among these students.

Project Description: To achieve the proposed objectives we have designed an unparalleled strategy to inspire freshmen to undertake STEM. This approach will help increase the number of highly qualified STEM graduates vital for the Nation's health and economy. *The specific proposed activities are:* i) Creation of this platform through the adaptation and optimization of Sendible, a commercially available tool to simultaneously manage the SNS, email and text message accounts of FUN-STEM; ii) design of orientation sessions to ensure that all students know how to create and use single or multiple social media accounts to interact with the platform; iii) scheduling of an initial synchronization of the social media account(s) of choice with the corresponding students account(s) in the platform; iv) design of online tutoring sessions and establishment of the 24/7 program; v) development of a training workshop for GRAs to administer the platform, and training of GTAs and undergraduates on how to use the platform for tutoring and inspiring students; and, vi) implementation of FUN-STEM in freshmen chemistry and physics courses at UCF, the second largest university in the country. Freshmen chemistry and physics courses offering traditional face-to-face tutoring will be used as control groups. To assess the impact of FUN-STEM, we will monitor the rates of retention, change of majors, and student progress towards their degrees using adaptable surveys and continuous evaluations of the program. We count with the participation as consultant & evaluator of the expert in social media education, Dr. Reynold Junco (ISU).

The ***Intellectual Merit*** of this project resides in the development of an advanced approach designed specifically for the needs and culture of the so called "Millennials" who currently dominate college campuses. This generation of students is habituated to customized products and services and to personalized attention. With a similar expectation of *à la carte* service from the educational system, Millennials will be assisted by FUN-STEM through a highly customizable technological platform *via* SNS, e-mail and text messages. Our proposal is based on previous studies that have shown that, with the adequate implementation of technology in a global world, SNS have a positive impact in the engagement and performance of Millennials in college courses. However, the full educational engaging potential of these tools has not been fully uncovered. In order to overcome the present challenge of inspiring freshmen to undertake STEM we *hypothesize*: '*Millennial freshmen interest in STEM is increased by the use of an adaptable and highly customizable platform that provides tutoring and immediate assistance when they need it the most, in any place and using their preferred channels of communications - SNS, email and text messages*'. The dual purpose of the proposed platform is the key element to effectively promoting STEM among freshmen students. The *à la carte* tutoring methodology to engage students in the course will pave a new road for promoting STEM using technology.

Broader Impacts: FUN-STEM will be designed, developed and implemented in the second largest university in the country. Approximately 5,000 freshmen students will be exposed to the novel platform during this project. The inherent nature of FUN-STEM is inclusive, *i.e.*, it encourages the participation of students of all different types of cultural, socio-economic and ethnic backgrounds and, underrepresented groups in college. FUN-STEM is expected to serve as an adaptable pilot program easily transplantable to other institutions. In addition, graduate students interested in chemistry and physics education will find an opportunity to work in these fields while participant GTAs will benefit from a unique opportunity that will enrich their teaching skills and could serve as a vehicle to implement FUN-STEM in their future institutions. A total of two GRAs, 12 GTAs and 12 undergraduate students will participate in FUN-STEM. The success of this project will transform the current approaches to college sponsored tutoring centers across the nation. Publications, conferences and social media will ensure project's dissemination.

Questions

Funded Projects

Award Abstract #2032668

Developing a National Research Agenda for STEM Education for Students with Visual Impairments (VI)

Investigator(s): Tiffany Wild wild.13@osu.edu (Principal Investigator)

Awarded Amount to Date: $88,539.00

ABSTRACT

The conference will convene researchers and other stakeholders to develop a STEM education research plan that will focus on STEM education of students with visual impairments. The goal is to identity and prioritize agenda topics that address the needs of this population, and to build capacity to conduct robust research focused on those needs. The conference agenda will include an analysis of gaps in the research, appropriate methodologies for this type of research, and strategies for translating the research to practice. The project is expected to advance knowledge and understanding about STEM education for students with visual impairments by defining a focused research agenda and positioning scholars who can conduct high quality fundamental STEM education research and build a community of practice.

Funded Projects

Award Abstract #2013144

Collaborative Research: Bridging the Gap Between Academia and Industry in Approaches for Solving Ill-Structured Problems

Investigator(s): Kristen Cetin cetinkri@msu.edu (Principal Investigator)

Awarded Amount to Date: $124,785.00

ABSTRACT

Engineers play a crucial role in the development of solutions to today's complex problems. Real world engineering problems are inherently ill-structured, complex, defined by both non-engineering and engineering constraints, often contain missing or conflicting information, and do not have one 'correct' solution as typically taught in engineering classrooms. In order to ensure that engineering graduates are competitive and well-prepared with the skills necessary for the complex problems in the workplace, efforts are needed to improve undergraduate education's focus on solving problems. This project will examine the ill-structured problem-solving approaches of undergraduate students, faculty, and professionals within civil engineering. The investigation will involve identifying similarities and differences between problem solving approaches used by engineering professionals and engineering students. Participants' approaches to problem solving and their personal characteristics (e.g., years of experience, demographics, learning style, creativity) will also be studied. Translation from research findings to educational practice will result in recommendations on improving the instruction of complex, ill-structured problem solving in undergraduate engineering education. Educational resources will be developed and disseminated widely to benefit both professors and students.

Funded Projects

Award Abstract #2025141

Detecting Student's Dual-Process Reasoning in Introductory Undergraduate Physics

Investigator(s): John Kelly jkelly8@tnstate.edu (Principal Investigator)

Awarded Amount to Date: $112,333.00

ABSTRACT

In this capacity building project, the investigator proposes to replicate a research project to investigate dual process reasoning in an undergraduate physics classroom at a Historically Black College and University. Dual process theories state that when faced with a decision, students may use both an autonomous system of cognition (T1S) and a reflective system (T2S) that relies on working memory and mental simulations. The current project builds on prior research that applied the heuristic-analytic theory of reasoning to examine students? intuitive thinking in the context of physics. The prior project studied concepts related to capacitors and mechanical waves. In the current project, the investigator will study concepts related to Newtonian mechanics. This research is intended to inform interventions that can help students develop valid intuitions and evaluate physical situations using formal physics reasoning. The investigator will implement a professional development plan to acquire skills and competencies to conduct STEM education research. Development activities include mentoring, and courses in multivariate statistics and in design and implementation of mixed methods research. In addition to its potential to enhance student success in physics and other STEM courses, the project will position the investigator to conduct future research on metacognition in students.