NATIONAL SCIENCE FOUNDATION
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ARLINGTON, VIRGINIA 22230

NSF 17-136

Dear Colleague Letter: Research on Methodologies for STEM Education

September 19, 2017

Dear Colleagues:

The EHR Core Research (ECR) program of the National Science Foundation's (NSF) Directorate for Education and Human Resources (EHR) wishes to notify the community of the intention to support fundamental research on methodologies that support valid inferences in STEM education. This Dear Colleague Letter (DCL) calls for research proposals to be submitted to the ECR program (NSF 15-509) that will develop and rigorously test new methodologies and grow the community's collective capacity to conduct rigorous research and evaluation on STEM learning and learning environments, workforce development, and broadening participation.

With this DCL, ECR invites proposals on the development, application, and extension of formal models and methodologies for STEM education research and evaluation, including methods for improving statistical modeling, qualitative modeling, measurement, replication, and learning analytics. This includes research on methodological aspects of new or existing procedures for data collection, curation, and inference in STEM education. Similarly, ECR seeks proposals related to collection of unique databases with cross-boundary value, particularly when paired with innovative developments in measurement or methodology (standard statistical modeling, qualitative research, measurement, replication and learning analytics). Proposers must demonstrate how advances in the methodology will support important theoretical insights in STEM education research or evaluation. Proposers are encouraged to explore a wide range of fundamental research projects (in the areas of quantitative, qualitative, measurement, replication, and learning analytics methodologies) that may address, but are not limited to, such topics as:

- Methodologies to study developmental trajectories of student learning of STEM content;
- Models and methodologies that increase external validity of STEM research results;
- Advances in research on evaluation in STEM education;
- Mediation and moderation analysis as they play out in clustered field settings to support STEM learning;
- Advances in quantitative research involving growth and interruptions to that growth (e.g., repeated measures designs);
- Advances in metasynthesis of qualitative research in STEM education;
- Advances in linguistic analysis applied to STEM education;

- Advances in construct validity;
- Advances in network analysis for use in STEM education;
- Advances in item level factor analysis;
- Development of models and methodologies to improve and build replication in STEM education research;
- Advances in the measurement of STEM human and social capital;
- Advances in methodologies to automate and validate the coding of video data in STEM settings;
- Advances in Bayesian or computational modeling of STEM education data;
- Advances in the application of machine learning approaches to STEM education;
- Improving methods for data sharing for STEM education research;
- Advances in scientometrics and citation analysis in relation to STEM education research;
- Improvements in the study of the diffusion of innovation in STEM education.

As described in the ECR program announcement, three levels of funding are available and should align with the maturity of the proposed work, the size and scope of the empirical effort, as well as the capacity of the research team to conduct the proposed research: (1) **Level I proposals** have a maximum award size of $500,000 and a maximum duration of 3 years; (2) **Level II proposals** have a maximum total award size of $1,500,000 and a maximum duration of 3 years; (3) **Level III proposals** have a maximum award size of $2,500,000 and a maximum duration of 5 years. Most, if not all, awards will be funded as Level I studies.

In addition, NSF is interested in supporting capacity building proposals through synthesis projects, conference proposals, and Early Concept Grants for Exploratory Research (EAGER) proposals.

Synthesis proposals seek support for synthesis of methodological knowledge on a topic of critical importance to STEM learning and for the diffusion of research-based knowledge to the STEM research community. An example of a synthesis project in this area could include the clarification of the status of research relative to growth modeling and how these models are taken up in STEM learning research with a specific emphasis on directions for new research (i.e., unanswered methodological questions and how answers to these questions would support the evidentiary warrants of STEM education research). Maximum award size for Synthesis proposals is $300,000 for a duration of up to two years.

Conference proposals seek support to conduct highly-focused conferences (or workshops) related to the research goals of the ECR program. Investigators are encouraged to propose workshops as one way to diffuse the research-based knowledge (perhaps developed through a synthesis award). The involvement of, and dissemination to, STEM education researchers is an important aspect of this work. Information about the preparing Conference Proposals is contained in the PAPPG Chapter II.E.7.

The **EAGER** funding mechanism may be used to support exploratory work in its early stages on untested, but potentially transformative, research ideas or approaches. This work may be considered especially "high risk-high payoff" in the sense that it, for example, involves radically different approaches, applies new expertise, or engages novel disciplinary or interdisciplinary perspectives. Potential investigators must contact an NSF program officer whose expertise is most

germane to the proposal topic prior to submission of an EAGER proposal. Requests may be for up to $300,000 and of up to two years duration. Information about the preparing EAGER Proposals is contained in the PAPPG Chapter II.E.2.

The annual deadline for submission of proposals to ECR is the second Thursday in September. Conference and EAGER proposals may be submitted throughout the year. The NSF also strongly encourages early career faculty to submit proposals.

Principal investigators interested in submitting proposals (or with other questions pertaining to this DCL) may contact one of the program directors:

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