



INFORMATIONAL WEBINAR  
OCTOBER 23<sup>RD</sup>, 2023

NSF 23-627  
Ideas Lab:  
Personalized Engineering Learning (PEL)

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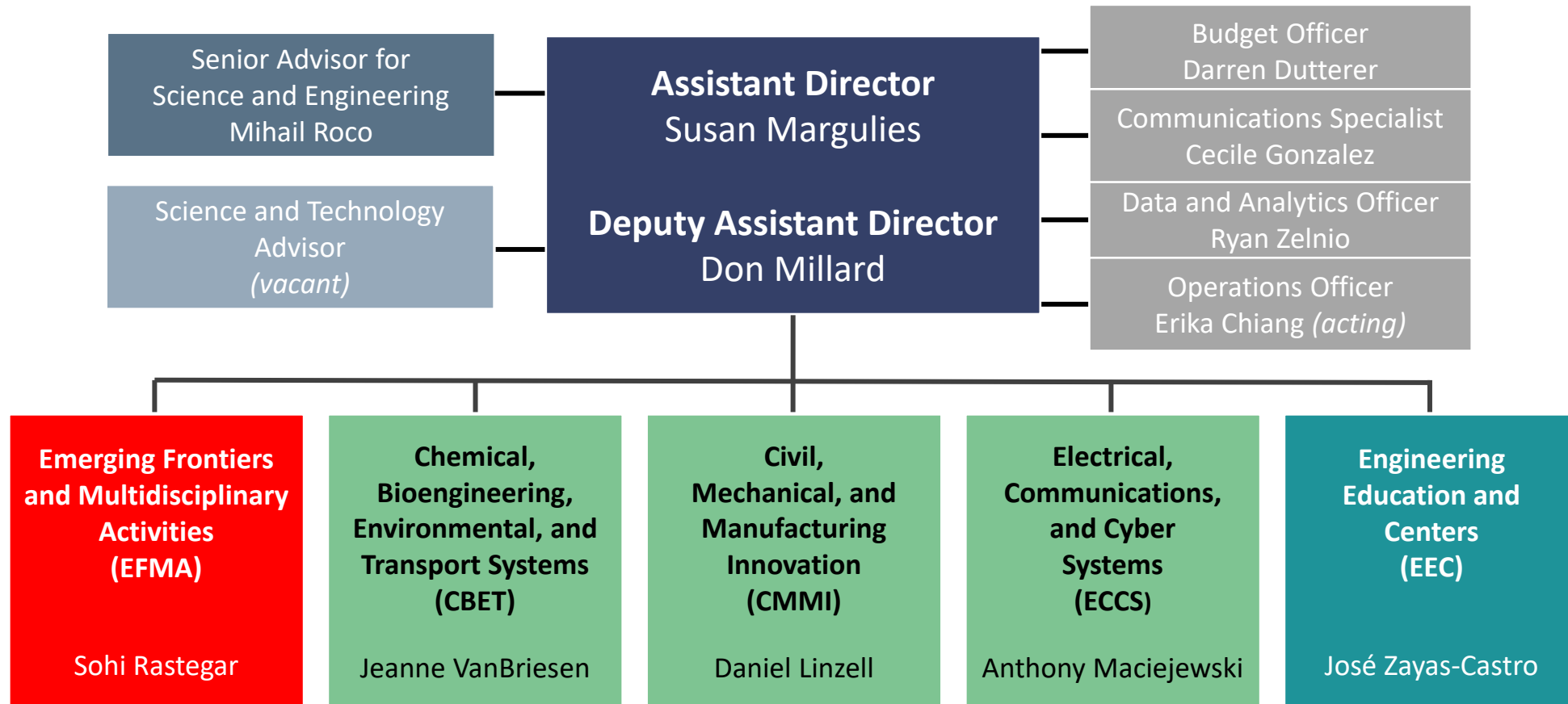
Directorate for Engineering  
Directorate for Computer and Information Science and Engineering  
Directorate for Social, Behavioral and Economic Sciences  
Directorate for STEM Education  
Directorate for Technology, Innovation and Partnerships

# AGENDA: October 23<sup>rd</sup>, 2023

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- 3:00 pm      Welcome from Don Millard  
Deputy Assistant Director, NSF/ENG
- 3:05 pm      Introduction of EFMA
- 3:10 pm      Overview of Personalized Engineering Learning Solicitation
- 3:45 pm      Questions

# NSF Directorate for Engineering



# The Emerging Frontiers in Research & Innovation (EFRI) Program

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The EFRI Program serves a critical role in helping the Engineering Directorate to focus on important emerging areas in a timely manner.

- **Community Driven** – Engages the research community (through a DCL) as well as NSF Program Directors to identify and fund a portfolio of projects in strategic emerging, interdisciplinary areas that may not be supported through current NSF programs, and in which ENG research plays the leading role.
- Uses **Potentially Transformative / High risk, High reward** and **Interdisciplinary** as criteria for project selection.
- Signature midscale project-funding mechanism in ENG (\$2M / 4 year projects)

# EFMA FY24 Activities

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- ❖ EFRI FY24 Topic: Engineering Organoid Intelligence
  - ❖ Announced April 2023; solicitation pending
- ❖ NSF Trailblazer Engineering Impact Award (NSF 23-629)
  - ❖ Webinar: October 12, 2023
- ❖ Ideas Lab: Personalized Engineering Learning (PEL)  
(NSF 23-627)
  - ❖ This webinar

# NSF 23-627: Goals of Webinar

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The goals of this webinar are:

- ❖ To inform the community about the *Personalized Engineering Learning (PEL) Ideas Lab* Solicitation
- ❖ To respond to questions from potential applicants

# PEL Program Team

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- Matthew Verleger, *Program Director Lead, ENG/EEC*
- Margaret Hjalmarson, *Program Director Co-Lead, EDU/DRL*
- Alexandra Medina-Borja, *Program Director, ENG/CMMI*
- Thomas Martin, *Program Director, CISE/IIS*
- Amy Wilson-Lopez, *Program Director, EDU/DRL*
- Dorian Davis, *Program Director, EDU/DGE*
- Christine Delahanty, *Program Director, EDU/DUE*
- Soo-Siang Lim, *Program Director, SBE/BCS*
- Lindsay Portnoy, *Program Director, TIP/TI*
- Louise R Howe, *Program Director, ENG/EFMA*

# Personalized Engineering Learning (PEL) Ideas Lab

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An Ideas Lab is an intensive meeting that brings together multiple diverse perspectives to focus on finding innovative cross-disciplinary solutions to a grand challenge problem.

The goal of the Personalized Engineering Learning Ideas Lab is to extend engineering education research to enable advanced personalization in pedagogy and assessment in a K-12 or higher education context.

The following broad areas have been identified as possible avenues to advance knowledge:

- Personalized engineering education
- Multimodal sensing for personalized learning systems
- Team-based personalized learning.



# Ideas Lab: Concept

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The Ideas Lab is an intensive, interactive, and free-thinking environment, where a diverse group of participants from a range of disciplines and backgrounds gets together - away from their daily routines - to immerse themselves in collaborative thinking processes in order to construct innovative solutions and approaches for identifying and tackling challenging problems.

The Ideas Lab in-person component will run over three days. This in-person meeting will be followed by a set of virtual meetings to allow the teams to further exchange and develop their ideas.

The participants will work collaboratively to identify and define the scope of the scientific, engineering, educational, and technology challenges relating to the design, development, and implementation of novel dynamic personalized learning systems.

# Ideas Lab: Workshop Stages

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The Ideas Lab workshop can be broken down into several stages:

- Defining the scope of the challenges
- Evolving common languages and terminologies amongst people from a diverse range of backgrounds and disciplines
- Sharing perspectives and understanding of the scientific challenges, as well as the diverse expertise brought by the participants to the Ideas Lab
- Taking part in break-out sessions focused on the challenges, using creative thinking techniques
- Capturing the outputs in the form of highly innovative research projects
- Using "real-time" peer review to develop projects at the Ideas Lab

# Personalized Engineering Learning (PEL)

## Ideas Lab: Objectives

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This Ideas Lab is intended to revisit the concept of personalized learning to understand and address the effects of individual learning differences and to develop new research projects that will advance the design of, and technology for, personalized learning solutions for engineering education.

This requires a thoughtful strategy around the identification, integration, and implementation of tools, resources and practices that are responsive to learners' interests and cognitive, physical, emotional, and educational needs.

Personalized learning for engineering education will build on previous NSF investments (for example in AI-driven learning and digital platforms for formal and informal settings) to break new ground toward the next frontier for engineering education and learning.

# Personalized Engineering Learning (PEL)

## Ideas Lab: [Avenues of Interest - I](#)

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### Personalized Engineering Education:

Engineering Education Research (EER) has increased our knowledge about learning in engineering classrooms, co-curricular (informal) settings and at work. Much of that research has been focused on discipline-level outcomes. This theme provides an opportunity to explore how to take those discipline-level outcomes and integrate them into more personalized learning experiences across multiple learning contexts and to increase our understanding of the engineering education system.

This theme will draw upon research in science, mathematics, computer science, and technology education and the learning sciences; but also requires an understanding of how engineering learning is distinct from non-engineering disciplines. Studies addressing this theme should represent a broad spectrum of stakeholders. Each project developed through the Ideas Lab will be expected to include a researcher with expertise in EER or educational systems.

# Personalized Engineering Learning (PEL)

## Ideas Lab: Avenues of Interest - II

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### Multimodal Sensing for Personalized Learning Systems (PLS):

Much of the recent focus of Personalized Learning Systems development has been on computing and AI systems for learning. This theme extends this work to develop and integrate multimodal sensors to better understand and model the physical and/or mental and cognitive cues and tasks that occur in engineering.

Multimodal data collection could involve physiological sensors, facial and speech recognition, and computer vision, with consideration for hardware and software needs for real-time data collection and analysis at scale.

Projects developed through the Ideas Lab should integrate consideration of societal impact and ethics.

# Personalized Engineering Learning (PEL)

## Ideas Lab: Avenues of Interest - III

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### Team-based Personalized Learning:

Engineering is a team-based activity and the need for collaboration increases as projects become more complex. This theme provides an opportunity to investigate team-based design and the potential for human-machine co-design or co-learning.

Expertise and developments in human factors, ergonomics, cognitive sciences, and learning sciences will enable the study of cognitive, social, and affective factors in design.

Projects developed through the Ideas Lab should integrate consideration of societal impact and ethics.

Projects on each theme may extend beyond pre-K-12 or college student learning to consider teachers, faculty, institutions, or community.

# Personalized Engineering Learning (PEL) Ideas Lab: **Timeline**

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## Preliminary Proposals:

Individuals self-nominate to participate in the Ideas Lab via pre-proposal submission.

Due: **November 29<sup>th</sup>, 2023**

## Ideas Lab:

3 days in-person in D.C. Metro area; **Week of February 26<sup>th</sup>, 2024**

3 virtual meetings (half-day); **March 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 2024**

## Full Proposals:

Will be invited from some or all of the project teams formed during the Ideas Lab.

Due: **May 8<sup>th</sup>, 2024**

# Solicitation Parameters

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# PEL Ideas Lab:

## Pre-Proposals – Due November 29, 2023

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Individuals interested in participating in the Ideas Lab must submit a pre-proposal:

- Must come from one individual; cannot include co-PIs or collaborators
- Title: "Ideas Lab: PEL Preliminary Proposal:" followed by a descriptive title
- Project Description: Maximum of 2 pages addressing 7 questions (*listed on next slide*)
- Proposal must include:
  - Biographical Sketch
  - Current and Pending Support
  - No Appendices or Supplementary Documents are permitted
- **Applicant MUST be Available: Feb 26<sup>th</sup>-Mar 1<sup>st</sup>, 2024 and Mar 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 2024**

# PEL Ideas Lab: Pre-Proposal Project Description

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## Project Description – Seven questions to be addressed:

1. Please provide a brief summary of your professional background, describing any relevant experience with pedagogical platforms, problem-solving, engineering design, motivation, self-efficacy, multimodal sensing, learning technologies, and pathways to new investigations in personalized learning. *(200 words)*
2. How do you see your expertise and interests contributing to realizing the goal of this Ideas Lab solicitation? Please frame your answer to explain your interests to an audience with different expertise to your own. *(250 words)*
3. Collaborative teamwork where everyone is regarded and respected as equal is essential to an innovation lab of this kind. What do you regard as your strengths here? *(100 words)*
4. The setting requires ease and ability to communicate with those from different disciplines and with different expertise to your own. How do you see yourself suited to this setting? *(100 words)*
5. How do you deal with potential conflict when adapting your ideas to fit into something that is strongly community-driven? *(100 words)*
6. The innovation lab is especially suited to individuals who can step outside their own area of expertise or interest, are positively driven, enjoy creative activity and can think innovatively. It is an intensive setting requiring you to develop novel approaches over several days with individuals you may not know. How do you consider yourself suited to this environment? *(100 words)*
7. What do you hope to gain from participating? *(100 words)*

# PEL Ideas Lab: Pre-Proposal Review

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Preliminary proposals will be reviewed by a Selection Panel led by the managing Program Directors.

- Up to 35 applicants will be selected for participation in the Ideas Lab
- Selection will be based on scientific expertise aligned with the goals of the Ideas Lab and willingness to work in teams
- Additional considerations will include diversity and potential for broader impact in education and on society
- Recommendations of the Selection Panel will be advisory to the managing PDs
- The PDs will recommend invite/do not invite decisions to participate, considering the input provided by the Selection Panel.

# PEL Ideas Lab:

## The Ideas Lab

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- Three full days in person; three half-day virtual sessions the following week
- Up to 35 participants selected from submitted pre-proposal applications
- Workshop Director(s) will assist in defining the topics and help facilitate discussions
- A small number of mentors and a team of professional facilitators will also participate
- The Workshop Director(s) and mentors will take full part in the Ideas Lab but will not be eligible to receive research funding
- Participants will work collaboratively to identify and define the scope of the scientific, engineering, educational, and technology challenges relating to the design, development, and implementation of novel dynamic personalized learning systems
- Over the course of the Ideas Lab, participants will dynamically develop and hone novel ideas about how the identified challenges may be addressed, and then use these ideas and approaches to develop innovative and potentially high-risk research projects.

# PEL Ideas Lab:

## Full Proposals - Due: May 8<sup>th</sup>, 2024

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Full proposals may be submitted only by invited teams following the Ideas Lab

- Full proposals based on project ideas developed through interactions at the Ideas lab should conform to the project outline developed at the conclusion of the meeting. If substantive changes are contemplated, an NSF Program Director should be contacted for guidance.
- Title: "Ideas Lab: PEL:" followed by a descriptive title
- A Management Plan must be submitted as a Supplementary Document (max. 5 pages) and must include:
  - A list of project personnel, including their affiliations, expertise, and project roles
  - A plan for team coordination and project management
  - A detailed project schedule
- The budget must include funding for travel to Washington, DC, for a PI or Co-PI and up to one other project participant to attend annual two-day PI meetings

# PEL Ideas Lab: Full Proposals – Review Criteria

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## NSF Merit Review Criteria

- Intellectual Merit
- Broader Impacts

## Additional Solicitation-Specific Criteria

- Full proposals derived from the Ideas Lab will be evaluated to determine:
  - Whether the scientific themes/objectives in the proposal are congruent with the ideas presented at the Ideas Lab, and
  - Whether any significant changes in project scope or resources from those presented at the Ideas Lab have been justified.

# Award Information

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**Anticipated Number of Awards:** 3

**Award Type:** Standard Grant or Continuing Grant

**Award Duration:** 2 years

**Award Amount:** Up to \$1,000,000

Subject to the availability of funds and compelling proposals.

# Eligibility: Organizations

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## **Who May Submit Proposals:**

- Proposals may only be submitted by:
  - Institutions of Higher Education (IHEs): Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members.
  - Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. that are directly associated with educational or research activities.
  - For-profit organizations: U.S.-based commercial organizations, including small businesses, with strong capabilities in scientific or engineering research or education and a passion for innovation.
  - Tribal Governments: The governing body of any Indian or Alaska Native tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian tribe under the Federally Recognized Indian Tribe List Act of 1994 (25 U.S.C. 479a, et seq.)

## **Limit on Number of Proposals per Organization: NONE**

- There are no restrictions or limits



# Eligibility: PI

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## Who May Serve as PI:

- There are no restrictions or limits.

## Limit on Number of Proposals per PI or co-PI: **One**

- An individual may participate as PI or co-PI on only one proposal submitted to this solicitation. There is no limit on the number of proposals for which an individual may participate as Other Senior Personnel.
- **If an individual is listed as PI or co-PI on more than one proposal to this solicitation, all proposals in excess of the limit for any person will be returned without review in the reverse order received.**

## Additional Eligibility Info:

- Inclusion of appropriate engineering education expertise in the leadership team is highly recommended.

# PEL Ideas Lab: Key Dates

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November 29<sup>th</sup>, 2023

Pre-Proposals due  
*(participant self-nomination)*

Feb 26<sup>th</sup>-Mar 1<sup>st</sup>, 2024

IDEAS Lab  
*In-person – three full days*

March 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 2024

IDEA Lab completion sessions  
*virtual – three half-day sessions*

May 8<sup>th</sup>, 2024

Full Proposal Deadline  
*(invited proposals only)*



# Questions & Answers:

## Individuals: Availability

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Question:

If an investigator will not be available for the planned dates of the Ideas Lab, should they still apply by submitting a pre-proposal?

Answer:

No.

An individual should only apply to participate in the Ideas Lab (i.e., submit a pre-proposal) if they are available for the planned Ideas Lab on Feb 26-Mar 1, 2024, and for the virtual completion meetings on Mar 4, 6, and 8, 2024.

# Questions & Answers:

## Participation Limit: Individuals

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Question:

Can an investigator be PI on one full proposal and co-PI on another full proposal?

Answer:

No.

An individual may participate as PI or co-PI on only one full proposal submitted to this solicitation.

There is no limit on the number of full proposals for which an individual may participate as Other Senior Personnel.

# Questions & Answers:

## Participation Limit: Organizations

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Question:

Is there a limit on the number of proposals that may be submitted by a single organization?

Answer:

There are no restrictions or limits.

# Questions & Answers:

## Participation Limit: Organizations

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Question:

How many participating organizations are allowed on a PEL proposal?

Answer:

There is no limit to the number of participating institutions allowed on a PEL full proposal.

Note however that pre-proposals may only involve a single investigator and a single institution.

# Questions & Answers:

## Project Ideas

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Question:

Do I need to have a project plan for the pre-proposal or by the time of arrival at the Ideas Lab (if I'm selected to participate)?

Answer:

Absolutely not. The goal of the Ideas Lab is to develop innovative projects in real time, leveraging the convergent expertise of the participants.

If selected, you should arrive at the Ideas Lab with an interest in exploring and working in this space and a willingness to collaborate towards solutions.

# Key website

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Please refer to the NSF/ENG website for current information.

[NSF.gov/eng/EFMA](https://www.nsf.gov/eng/EFMA)