



# Improving **U**ndergraduate **S**TEM **E**ducation **Initiative**



## Using Artificial Intelligence (AI) to Enhance Learning for All Students

Dr. Narges Norouzi

Dr. Ibukun Osunbunmi



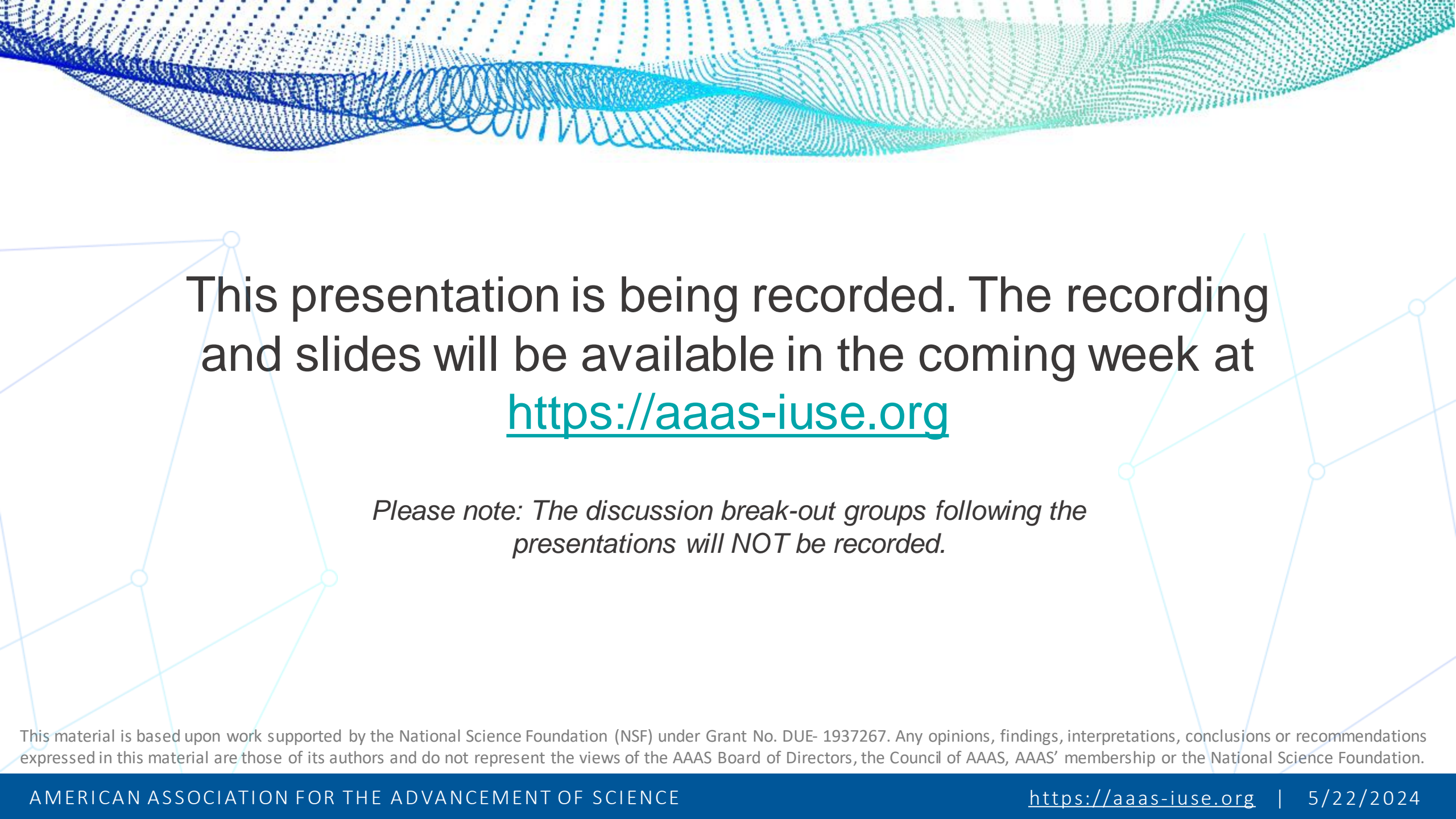
@IuseProgram



AAAS IUSE Initiative

This material is based upon work supported by the National Science Foundation (NSF) under Grant No. DUE- 1937267. Any opinions, findings, interpretations, conclusions or recommendations expressed in this material are those of its authors and do not represent the views of the AAAS Board of Directors, the Council of AAAS, AAAS' membership or the National Science Foundation.

# WORKSHOP



This presentation is being recorded. The recording and slides will be available in the coming week at <https://aaas-iuse.org>

*Please note: The discussion break-out groups following the presentations will NOT be recorded.*


This material is based upon work supported by the National Science Foundation (NSF) under Grant No. DUE- 1937267. Any opinions, findings, interpretations, conclusions or recommendations expressed in this material are those of its authors and do not represent the views of the AAAS Board of Directors, the Council of AAAS, AAAS' membership or the National Science Foundation.



## Closed Captioning:

To download the transcript or view the full transcript, please click the “CC” button at the bottom of your screen.

This material is based upon work supported by the National Science Foundation (NSF) under Grant No. DUE- 1937267. Any opinions, findings, interpretations, conclusions or recommendations expressed in this material are those of its authors and do not represent the views of the AAAS Board of Directors, the Council of AAAS, AAAS’ membership or the National Science Foundation.



The AAAS-IUSE initiative supports faculty, students, and the greater undergraduate STEM education community by disseminating research and knowledge about STEM teaching, learning, equity and institutional transformation.

Check out our website to learn more and view: <https://aaas-iuse.org>

- Blog
- Workshops
- Summer Labs On-Demand
- Resources
- Lessons Learned During COVID
- NSF IUSE Proposal Preparation Toolkit



@IuseProgram



AAAS IUSE Initiative

This material is based upon work supported by the National Science Foundation (NSF) under Grant No. DUE- 1937267. Any opinions, findings, interpretations, conclusions or recommendations expressed in this material are those of its authors and do not represent the views of the AAAS Board of Directors, the Council of AAAS, AAAS' membership or the National Science Foundation.



# Improving **U**ndergraduate **S**TEM **E**ducation **Initiative**



## Using Artificial Intelligence (AI) to Enhance Learning for All Students

Dr. Narges Norouzi

Dr. Ibukun Osunbunmi



@IuseProgram



AAAS IUSE Initiative

This material is based upon work supported by the National Science Foundation (NSF) under Grant No. DUE- 1937267. Any opinions, findings, interpretations, conclusions or recommendations expressed in this material are those of its authors and do not represent the views of the AAAS Board of Directors, the Council of AAAS, AAAS' membership or the National Science Foundation.

# WORKSHOP

# Using Artificial Intelligence (AI) to Enhance Learning for All Students

Narges Norouzi

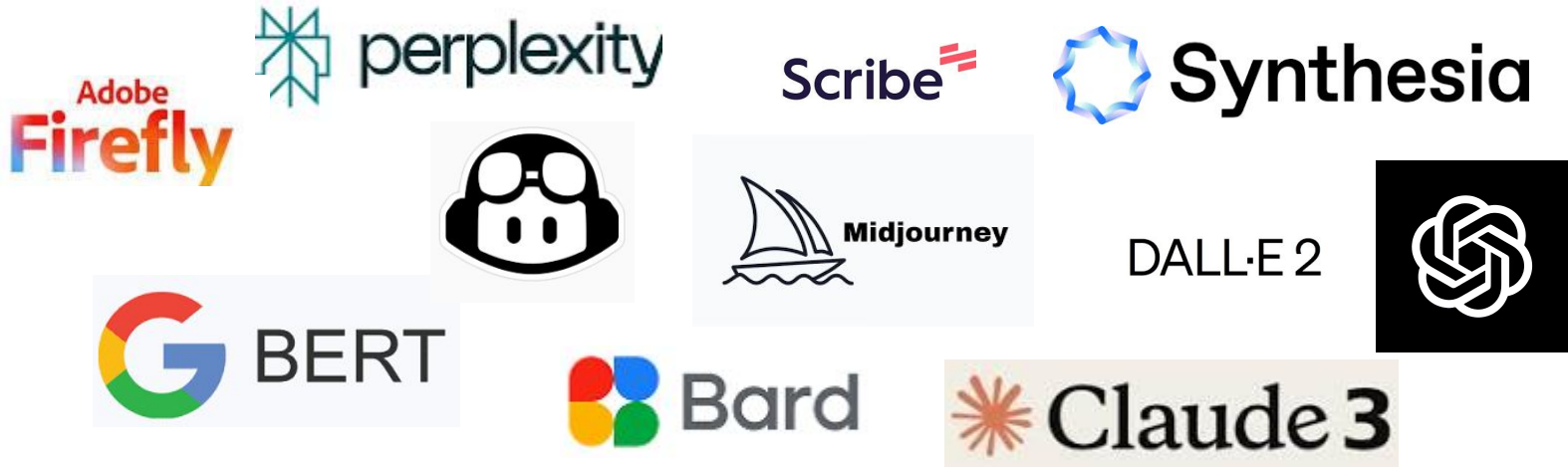
Department of Electrical Engineering and Computer Science

University of California Berkeley

# Introduction

- Welcome and introduction
- Workshop objectives
  - Understand AI's role in education
  - Explore benefits and challenges
  - Discuss future trends

# The Intersection of AI and Education



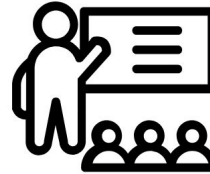
# AI Systems Impacting Students and Educators



## Students

Students often use generative AI systems to get support on:

- Essays,
- Programming tasks,
- Obtaining general outline and information on a context.



## Educators

Educators investigate:

- How to incorporate generative AI in their courses from using tools to deploying course-specific AI features, and
- Professional development and content creation.

# Educators: AI-Based Support Systems

## Administrative Assistance

- Assignment submission systems (e.g., GradeScope, ClassDojo)
  - Auto-grading
  - Plagiarism Detection
  - Compliance Check
- Attendance



## Lesson Planning

- Designing curriculum and instructional materials (e.g, Watson Education Classroom)

## Professional Development

- Resource recommendation
- Customized content

# Students: Personalize Learning

## Adaptive Learning Systems

- AI systems that can create adaptive learning pathways by considering students' needs, skills and goals
  - Chatbots in Computing courses such as Harvard's CS50 bot and Berkeley's 61A bot
  - Github co-pilot
  - DreamBox, Knewton, etc.



## Customized Content

- AI systems that adjust content based on real-time data from students' performance
  - Worked Example Authoring Tool
  - Randomized assessments using PrairieLearn
  - E.g., Smart Sparrow and McGraw-Hill's ALEKS





---

## Transforming Teacher-Student Dynamic

- Roles are being redefined:
  - Teachers are more in facilitator roles
  - Students are taking more active role in their learning
- Tutoring landscape is redefined with the AI-tutoring systems (e.g., specialized bots in courses, Carnegie Learning)
- Communication is enhanced through bots for Q&A

# The Shift - Teaching

- Traditional methods
  - Lecture-based instruction with standardized testing
- AI-driven innovation
  - Flipped classrooms, project-based learning that are enhanced by AI systems
  - AI-based active learning exercises in the classroom
  - Teaching through a sequence of worked examples

Flipped Classroom



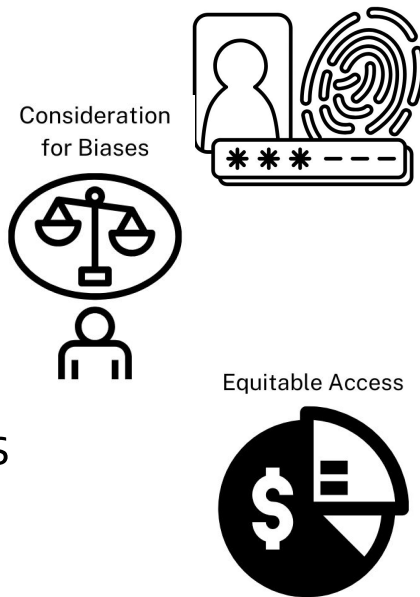
# The Shift - Content Creation

- Automated content creation
  - Worked example generation
  - Randomized formative and summative assessments
  - Course and lecture planning and refinement
- Innovative delivery methods
  - Multimedia presentations
  - Interactive simulations
  - Embedded active learning exercises and interactive learning platforms (e.g., Kahoot!, Nearpod, Slido, Quizlet)
  - On-demand help through bots



# Ethical Considerations

- Data privacy
  - FERPA and other compliance considerations might enforce particular infrastructure requirements for deploying new AI systems
- Biases in AI systems
- Cost factors and required trainings can widen the access gap to AI-based educational resources



# Where Is AI Education Heading Next?

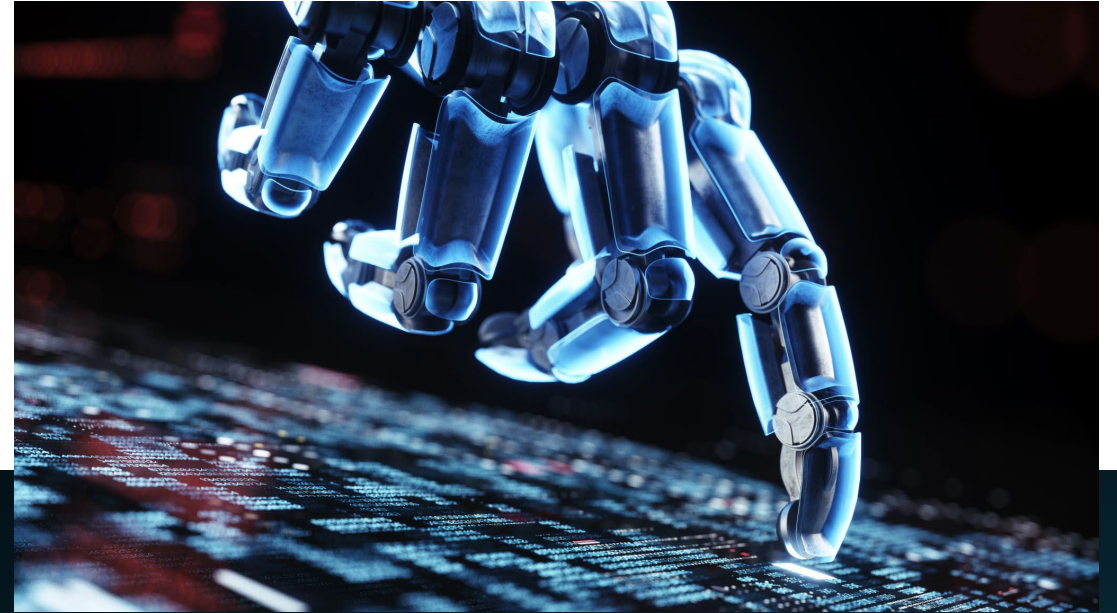
- Advanced reinforcement learning
  - To consider pedagogical constraints
  - To optimize short-term and long-term learning outcomes
- Integration of Virtual Reality (VR) and Augmented Reality (AR)
  - Lab simulations, hands-on learning, and AR-enhanced books
- Multi-modal AI systems (e.g., gpt4-o, Gemini, etc.)
- Shift in educational landscape
  - Automating routine tasks and shifting the focus to higher-order thinking
- Understanding long-term impacts and ethical and societal implications

# Thank You!

[norouzi@berkeley.edu](mailto:norouzi@berkeley.edu)

# Using Artificial Intelligence (AI) to Enhance Learning for All Students

Ibukun Osunbunmi, PhD,  
Assistant Research Professor



**PennState**  
College of Engineering

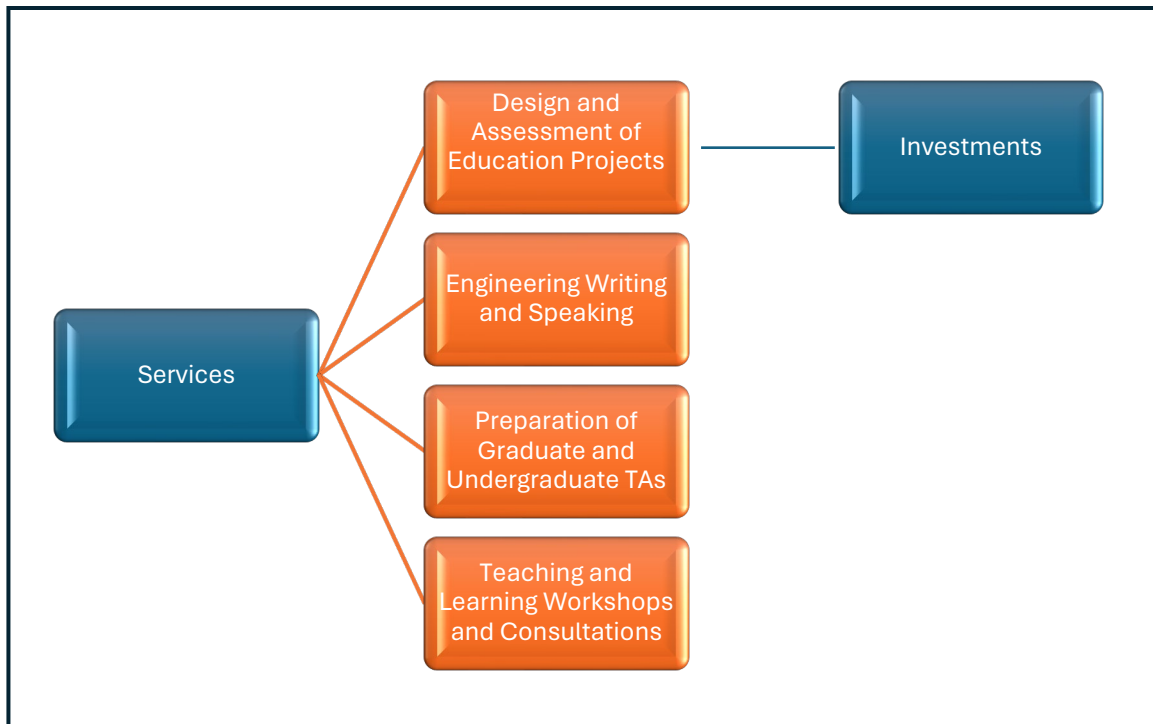
**LEONHARD CENTER**

# Ice Breaker

- Name, position, college, and Institution.
- Share a six-word story on AI.



# The mission of the Leonhard Center is to catalyze and support innovative teaching, learning, and assessment in the College of Engineering.



- Workshops and consultations
- Engineering Ambassadors
- Writing and speaking events and support
- Grants from the Leonhard Center
- Support for external funding
- NSF CAREER proposal development
- Graduate TA development
- Undergraduate Learning Assistant Program



# Ibukun Osunbunmi

Assistant Research Professor,  
Assessment and Instructional Support Specialist

Reasons to contact Ibukun:

- Workshops and seminar
- Assessment and Instructional Support.
- Collaboration on engineering education-related research and grants.
- Formal pedagogical training of engineering teaching assistants.

## Assessment

LC-funded projects

Externally-funded projects

COE projects

## Instructional Support

Workshops!

Individual consultation

Faculty Learning Communities

Engineering Education

ART in Engineering

Inclusive STEM Teaching

## Personal Research

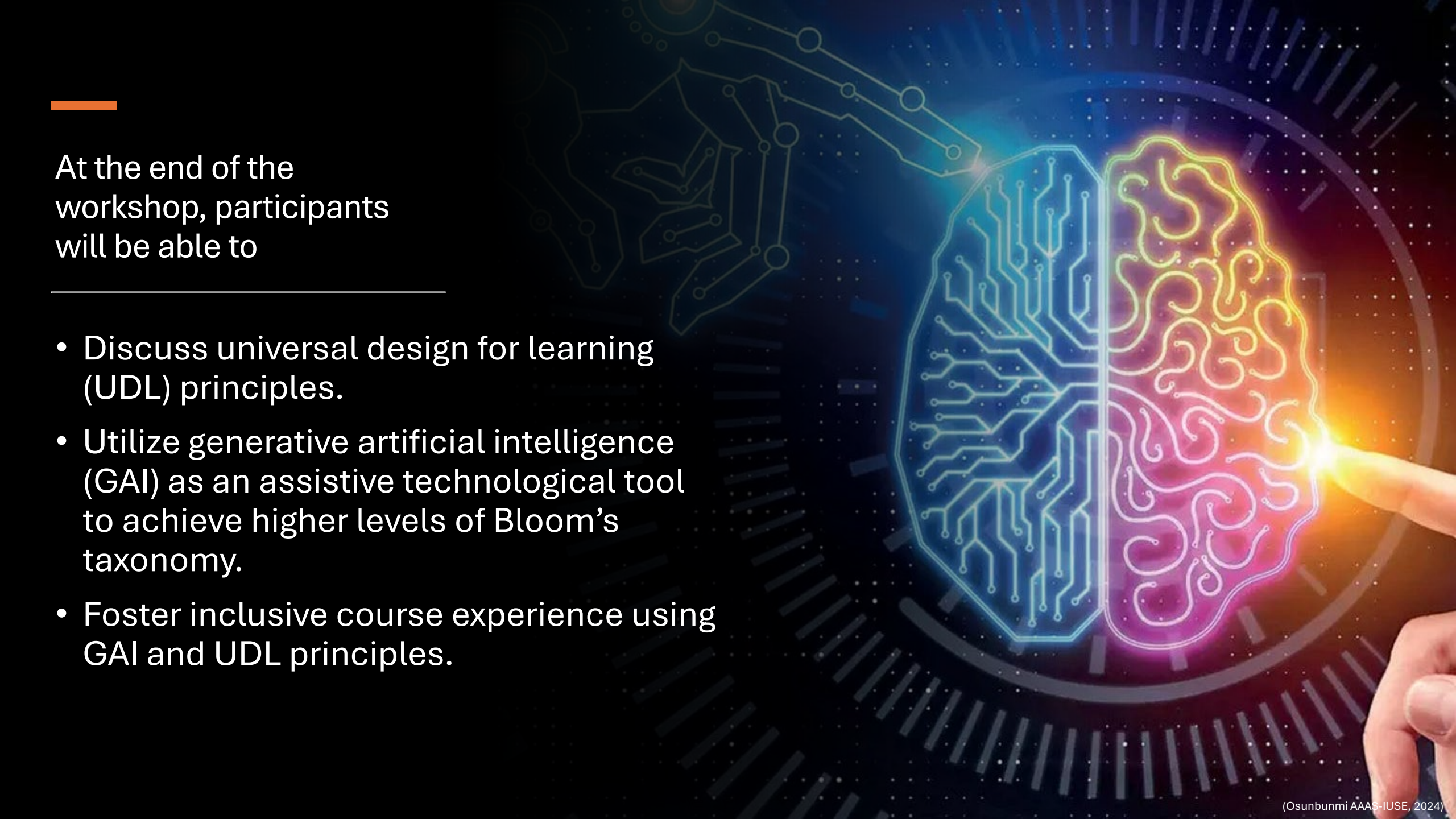
Faculty Development!

Broadening Participation in STEM

Engagement

Inclusive & Online Pedagogy

Technology Enhanced Learning

A hand is pointing towards a glowing brain graphic. The brain is split vertically: the left side is blue and composed of circuitry, while the right side is yellow and orange with organic, wavy patterns. The background is dark with a circular grid and some faint circuitry lines.

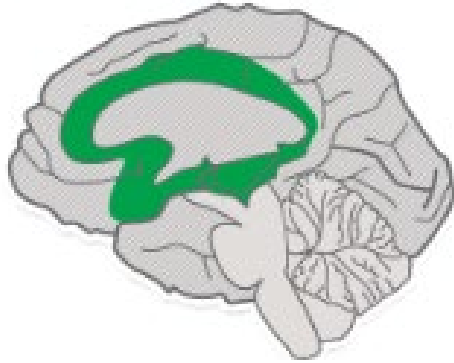
At the end of the workshop, participants will be able to

- Discuss universal design for learning (UDL) principles.
- Utilize generative artificial intelligence (GAI) as an assistive technological tool to achieve higher levels of Bloom's taxonomy.
- Foster inclusive course experience using GAI and UDL principles.

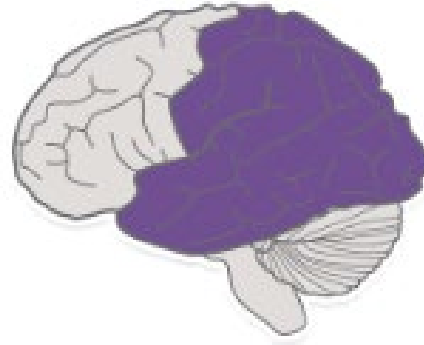
Most faculty design for the average student, which does not exist, UDL recommends that instructors be ***deliberate, and proactively prepare for all kinds of learners*** that will walk into our class.



AFFECTIVE NETWORKS:  
THE **WHY** OF LEARNING



RECOGNITION NETWORKS:  
THE **WHAT** OF LEARNING



STRATEGIC NETWORKS:  
THE **HOW** OF LEARNING



The universal design for learning principles advocates improving and optimizing teaching and learning for all people based on scientific insights into how humans learn\*.

\* <https://udlguidelines.cast.org/>

Generative artificial intelligence can be leveraged to implement UDL principles and facilitate an inclusive course experience.

**The quality of the case studies (output) you generate from your AI tool will depend on how well you frame your prompt.**

### **Iterate on Initial Prompt with Desired Details**

**Class Size**

**Class  
Demographics**

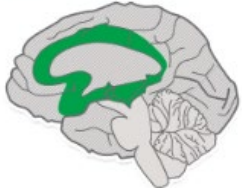
**Class Type**

**Bloom's  
Taxonomy**

**HHW of society**

**Solve in teams**

**Solve using AI**



# Providing multiple means of engagement makes students purposeful and motivated learners.

Design*	Guideline*	Checkpoints*	Leverage Generative Artificial Intelligence (GAI)
Access	Recruiting Interest	Optimize individual choice and autonomy	Use GAI to develop multiple case studies/real-life problems that students can pick from. You can use prompts and class material to aid the development.
Build	Sustaining Effort and Persistence	Foster collaboration and community	Group students into teams and let GAI be the last team member, serving as a brainstorming partner in generating solutions.
Internalize	Self-Regulation	Develop self-assessment and reflection	Let students reflect on their brainstorming experience with GAI. Students should note and be ready to report on GAI's strengths and weaknesses.

\* <https://udlguidelines.cast.org/>



# Providing multiple means of representation makes students resourceful and knowledgeable learners.

Design*	Guideline*	Checkpoints*	Leverage Generative Artificial Intelligence (GAI)
Access	Perception	Offer alternatives for auditory information	Use GAI to develop charts and visuals.
Build	Language and symbols:	Promote understanding across languages	Use GAI to translate class material into a different language. Tell your students that GAI has this capacity. This is good for OER.
Internalize	Comprehension	Maximize transfer and generalization	Use GAI to present problems in different contexts. GAI can provide explicit, supported opportunities to generalize learning to new situations.

\* <https://udlguidelines.cast.org/>



# Providing multiple means of action & expression makes students strategic and goal-directed learners.

Design*	Guideline*	Checkpoints*	Leverage Generative Artificial Intelligence (GAI)
Access	Physical action	Optimize access to tools and assistive technologies	GAI tools that will be used for academic activities should be free and accessible to all students.
Build	Expression and communication	Use multiple media for communication	Utilize GAI to solve problems in different ways. Let students analyze the solution(s) and respond using any media/tool they choose.
Internalize	Executive functions	Support planning and strategy development	Encourage students to utilize GAI to develop a one-month plan for a class project.

\* <https://udlguidelines.cast.org/>

# Final Words on Artificial Intelligence



01

Assume this is the worst AI you will ever use

02

Be the human in the loop

03

Treat AI like a person (but tell it what kind of person it is)

04

Always invite AI to the table

Thank you

# Resources

- Mollick Ethan (2024). Co-intelligence, living and working with AI. Penguin Publication.
- Bowen, J. A., & Watson, C. E. (2024). Teaching with AI: A Practical Guide to a New Era of Human Learning. Johns Hopkins University Press.
- Universal Design for Learning guideline website: <https://udlguidelines.cast.org/>.



# Improving **U**ndergraduate **S**TEM **E**ducation **Initiative**



## Using Artificial Intelligence (AI) to Enhance Learning for All Students

Dr. Narges Norouzi

Dr. Ibukun Osunbunmi



@IuseProgram



AAAS IUSE Initiative

This material is based upon work supported by the National Science Foundation (NSF) under Grant No. DUE- 1937267. Any opinions, findings, interpretations, conclusions or recommendations expressed in this material are those of its authors and do not represent the views of the AAAS Board of Directors, the Council of AAAS, AAAS' membership or the National Science Foundation.

# WORKSHOP



*Thank you for attending!*

Slides and recording will be available in the coming days.

We value your feedback, please take a few minutes to complete the survey.



@IuseProgram

<https://www.aaas-iuse.org>



AAAS IUSE Initiative

This material is based upon work supported by the National Science Foundation (NSF) under Grant No. DUE- 1937267. Any opinions, findings, interpretations, conclusions or recommendations expressed in this material are those of its authors and do not represent the views of the AAAS Board of Directors, the Council of AAAS, AAAS' membership or the National Science Foundation.