

# Overview of AI/ML in Education and ISEA Logistics

## ISEA Session 1

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University of Washington

01.24.2025

# Learning Objectives/Agenda

1. Introduce the instructors and the students to each other
1. Introduce foundational concepts: data science, AI, ML and human-centered, domain specific data science, data science in education
1. Introduce the human-centered data science cycle and emphasize the role of governance and responsible AI/ML
1. Provide an overview of the ISEA schedule and resources
1. Get organized: logistics, data collection efforts

# Instructors



Dr. Min Sun  
Principal Investigator  
Professor in Education, Founder and Co-Director of EPAL



Dr. David A. C. Beck  
Co-Principal Investigator  
Director of Education and Research at eScience Institute, Research Associate Professor in Engineering



Dr. Sarah Stone  
Co-Principal Investigator  
Executive Director of the University of Washington eScience Institute



Dr. Patrick C. Kennedy  
Co-Principal Investigator  
Senior Research Associate, University of Oregon



Dr. Lief Esbenshade  
Assistant Director of Research and Technology Development, AmplifyGAIN



Dr. Jing Liu  
Assistant Professor  
University of Maryland



Dr. David Knight  
Associate Professor  
University of Washington College of Education



Dr. Wei Ai  
Assistant Professor  
University of Maryland



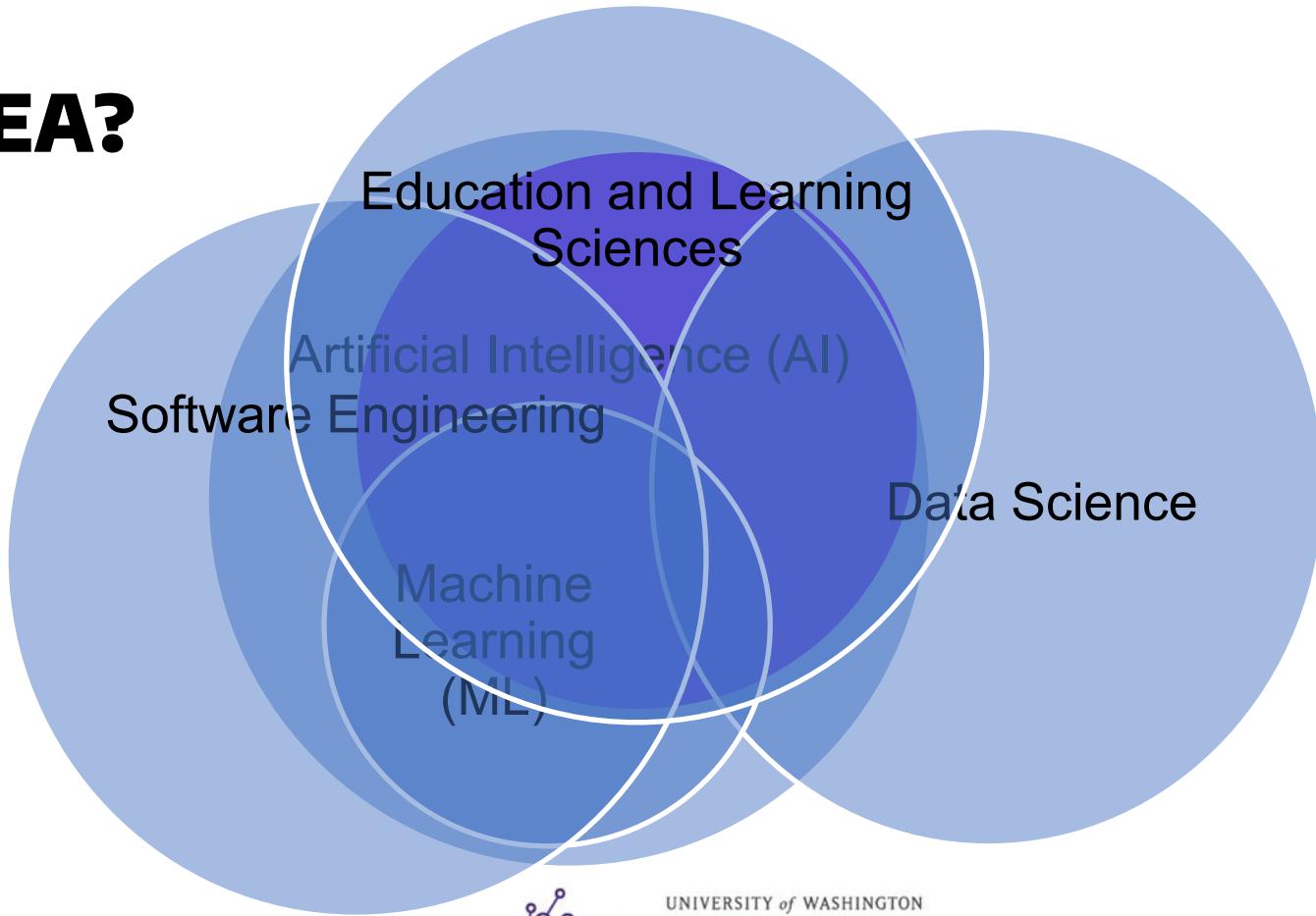
Dr. Christopher A. Candelaria  
Assistant Professor  
Vanderbilt University



Dr. Shawon Sarkar  
Senior Data Scientist  
College of Education, University of Washington

# What is ISEA?

A multidisciplinary, multisector intersection focus in AI/ML in educational science and product development



# What is AI?

## Understanding AI Simply

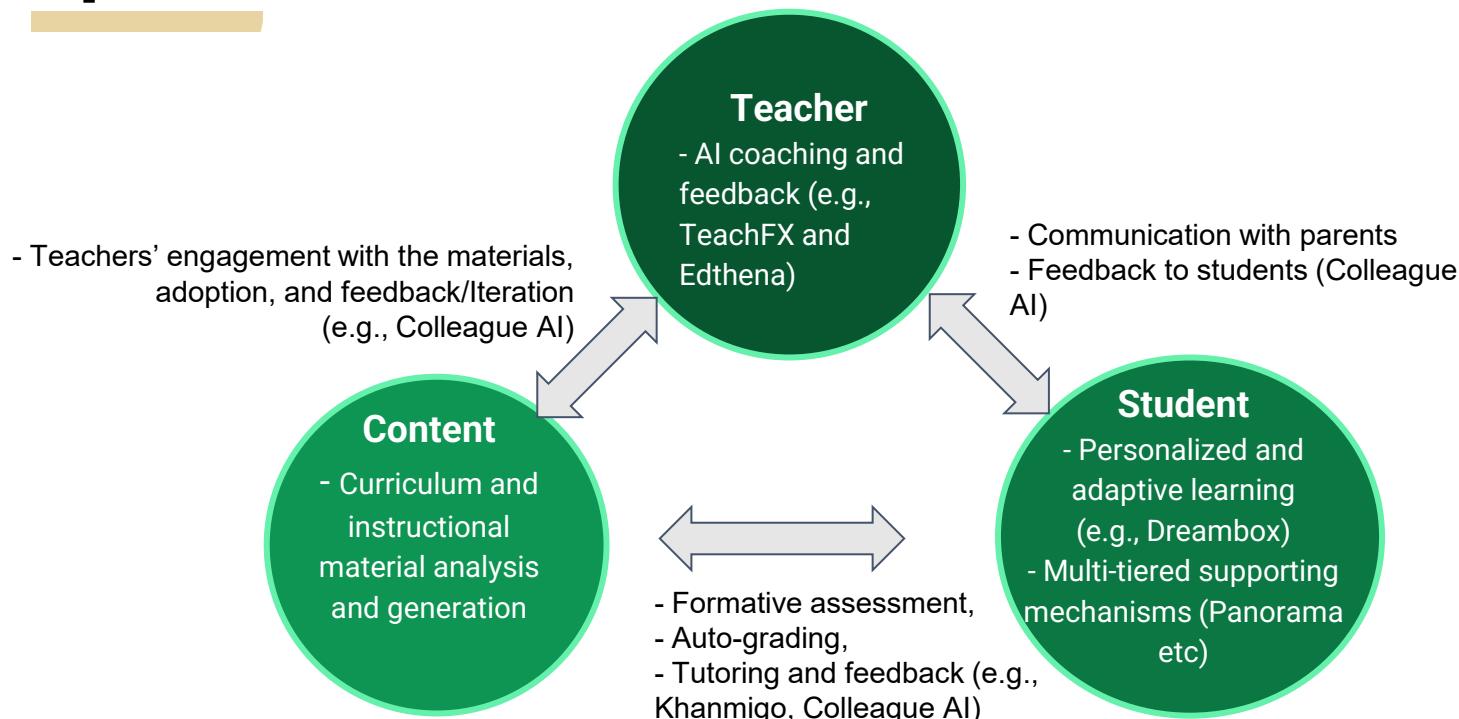
- > Artificial Intelligence (AI) is **technology** that helps **computers think and learn** in ways similar to humans.
- > At its core, AI **uses math and computer code** to:
  - Find patterns in large amounts of information
  - Learn from new information
  - Make decision, predictions or suggestions.

# **My Feeling About This Field:**

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- > **This field is moving so RAPIDLY!**
- > **The lines of different disciplines will blur even more.**
- > **A new generation of scholars and edtech workforce emerges.**

# AI and ML-Powered Data Science Methods Can Influence Many Aspects of Classroom Instruction



# Dr. Sun's Concept of AI As The Third Agent In Classroom Instruction: How AI will Transform Teaching and Learning?

> See [Dr. Sun's Blog](#) on Colleague AI's Platform

The “Third Agent” in classroom, interacting with teachers and students:

- **Dynamic, engaging content**
- **Personalization**
- **Collaborative learning**

(by Dr. Min Sun)



*Note. Image generated by Colleague AI*

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## Example 1: Dynamic Generation of Content

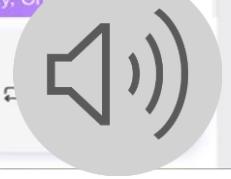
That's a great approach, Charlie! But what if I told you there's another way to solve this problem? What if we grouped the numbers differently?

Really? How would that work?

Well, instead of multiplying 2 and 3 first, we could multiply 3 and 4 first. So it would look like this:  $2 \times (3 \times 4) = 2 \times 12 = 24$ . Notice how we got the same answer?

Wow, that's interesting! But why does that work? And why is it important?

That's the magic of the associative property, Charlie!



# Exploring the Magic of Multiplication: Unraveling the Associative Property

## Learning Objectives

By the end of this lesson, students will be able to:

- 1. Review and demonstrate proficiency in single-digit multiplication (Understanding).
- 2. Explain the associative property of multiplication using mathematical language and visual representations (Understanding).
- 3. Apply the associative property to solve multi-factor multiplication problems efficiently (Applying).
- 4. Analyze and solve word problems involving the associative property of multiplication (Analyzing).
- 5. Create their own examples demonstrating the associative property and explain their reasoning to peers (Creating).

## Materials

1. Whiteboard and markers
2. Student worksheets with multiplication problems and word problems
3. Colored index cards (three different colors)

## Example 2: Personalized Learning

A parent (Dr. Sun here) works with AI to explain to her 3rd grader about how a light bulb completes a circuit.

The screenshot shows a digital conversation interface. At the top, there are icons for a video camera, a microphone, and a document, followed by the text "You" and a small profile picture. Below this is a purple box containing an image of a light bulb and the text "Observe the image of a light bulb. Explain how the light bulb completes a circuit." The AI, named Claire, is represented by a white box with a blue border. She has a small profile picture and the text "Claire AI" above her message area. Her message is: "I see you're on the right track! You've correctly identified that the light bulb uses energy in the circuit. That's a great start. Let's dig a little deeper to understand how the light bulb actually completes the circuit." Below this, she asks: "Take a closer look at the image of the light bulb. Can you describe what you see inside the bulb?" She then asks: "Now, think about these questions:" followed by a numbered list of three questions. At the bottom of the AI's message area is a button labeled "Show reflection". The bottom of the screen features a toolbar with icons for a magnifying glass, a checkmark, a plus sign, and a refresh symbol. A text input field at the bottom says "Press 'Enter' to continue...".

Observe the image of a light bulb. Explain how the light bulb completes a circuit.

Claire AI

Show chain of thought

I see you're on the right track! You've correctly identified that the light bulb uses energy in the circuit. That's a great start. Let's dig a little deeper to understand how the light bulb actually completes the circuit.

Take a closer look at the image of the light bulb. Can you describe what you see inside the bulb?

Now, think about these questions:

1. What material do you think the thin wire inside the bulb is made of?
2. How does this wire connect to the base of the bulb?
3. When we screw a light bulb into a socket, what parts of the bulb make contact with the socket?

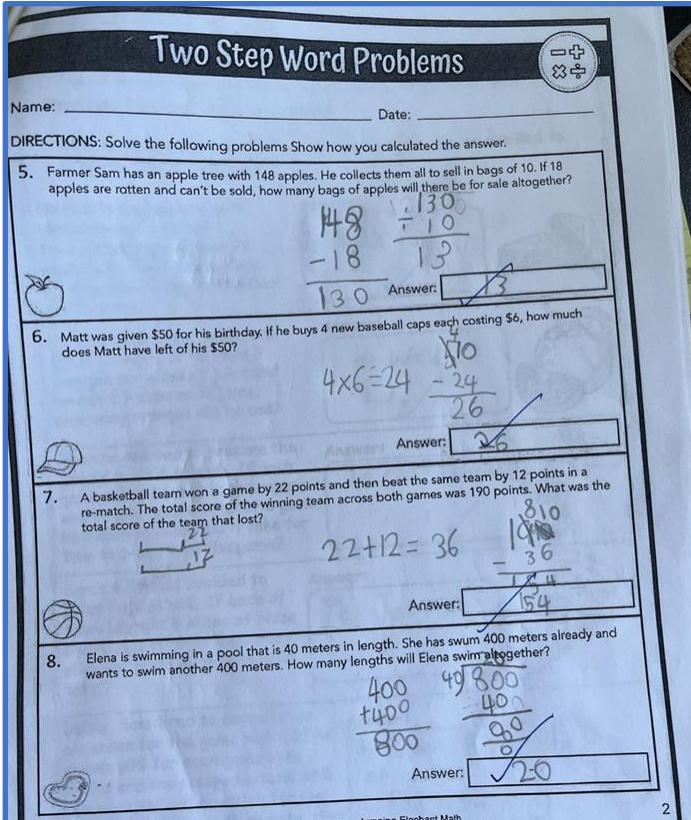
Considering these points, how do you think electricity might flow through the bulb? Remember, for a circuit to be complete, electricity needs a path to flow from one point back to another.

Show reflection

IES

VERSITY OF REGION 10

# Example 3: Detailed, Individualized Feedback



AI Assistant					
Based on the image provided, I will grade the student's work on the "Two Step Word Problems" worksheet.					
Student 1					
Item	Standard	Score	Justification	Strengths	Areas for Improvement
5. Farmer Sam's apple problem	3.OA.D.83 (Strategic Thinking)	3	Student correctly solved the two-step problem, showing work for $148-18=130$ and $130 \div 10=13$ . The answer of 13 bags is correct.	- Accurate calculations- Clear presentation of work- Correct final answer	- Could show equation with a variable for unknown quantity
6. Matt's birthday money problem	3.OA.D.83 (Strategic Thinking)	3	Student correctly calculated $4 \times 6=24$ and $50-24=26$ , arriving at the correct answer of \$26.	- Correct multiplication and subtraction	- Could show equation with a variable for unknown quantity
7. Basketball team score problem	3.OA.D.83 (Strategic Thinking)	3	Student correctly added $22+12=34$ and subtracted $190-34=156$ , arriving at the correct answer of 156 points.	- Correct addition and subtraction	- Could show equation with a variable for unknown quantity
8. Elena's swimming problem	3.OA.D.84 (Extended Thinking)	3	Student correctly added $400+400=800$ and then divided $800 \div 40=20$ , arriving at the correct answer of 20 lengths.	- Correct addition and division	- Could show equation with a variable for unknown quantity

"This was the most helpful AI ever! It helped me understand the entire algorithm and helped me finish 2x faster! Thank you!"

– Unsolicited feedback from a 7th grader

Overall Score: 13 out of 16

Overall Assessment: The student demonstrated the ability to solve two-step word problems using various operations. The student shows clear work for each problem, uses appropriate operations (addition, subtraction, multiplication, and division), and arrives at correct answers for all problems.

Comments: Strengths:

- Excellent problem-solving skills across all operations
- Consistent in showing step-by-step process
- Accurate calculations in all problems
- Correct interpretation of problem requirements

Areas for Improvement:

- Practice representing problems using equations
- Consider adding units (e.g., dollars, points) to final answers
- Continue to develop skills in more complex multi-step problems

Overall, the student shows a very good grasp of solving two-step word problems. To further enhance their skills, they could focus on representing problems using equations and ensuring they include units in their final answers. Keep up the great work!

# New Vision of AI In Education

> See [Dr. Sun's Blog](#) on Colleague AI's Platform

## Key AI Technology Breakthroughs

Major AI companies have shared their 2025 anticipations and key technologies they are developing.

To summarize, we see several key trends that are relevant for our stakeholders.

- **Multimodal AI** is revolutionizing how we process and integrate different types of content (text, images, and voice), creating richer, more immersive virtual environments closer to our real-life experience.
- **Multi-agent AI** systems are enabling collaboration among specialized AI agents, each contributing unique domain expertise and playing specific roles. They are coordinated to solve problems through agent-to-agent interaction.
- **Enhanced reasoning capabilities**, powered by improved data quality and advanced training methods, are delivering more sophisticated analytic solutions to improve accuracy and relevance of AI responses and recommendations.
- **Physical AI robotic systems** will continue to advance, evolving from futuristic concepts into everyday reality. These innovations will integrate hardware and software technologies, developing applications for both industrial processes and daily use.

# Balanced Understanding about AI

- > We need to move beyond hype and fear.
- > AI is a powerful tool, but not magic, and certainly cannot replace human intelligence.
- > AI use should focus on augmenting human capabilities.
- > AI has been rapidly penetrating our lives, which highlights the importance for us to prepare our students to develop a balanced understanding about AI.

# AI in Education Policy and Guidelines

- > **Department of Education AI Guidance**
  - [Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations](#)
  - [Designing for Education with Artificial Intelligence: An Essential Guide for Developers](#)
- > [OSPI's AI Guideline](#)
- > [Council of the Great City Schools](#)
- > [UNESCO's AI Guideline](#)

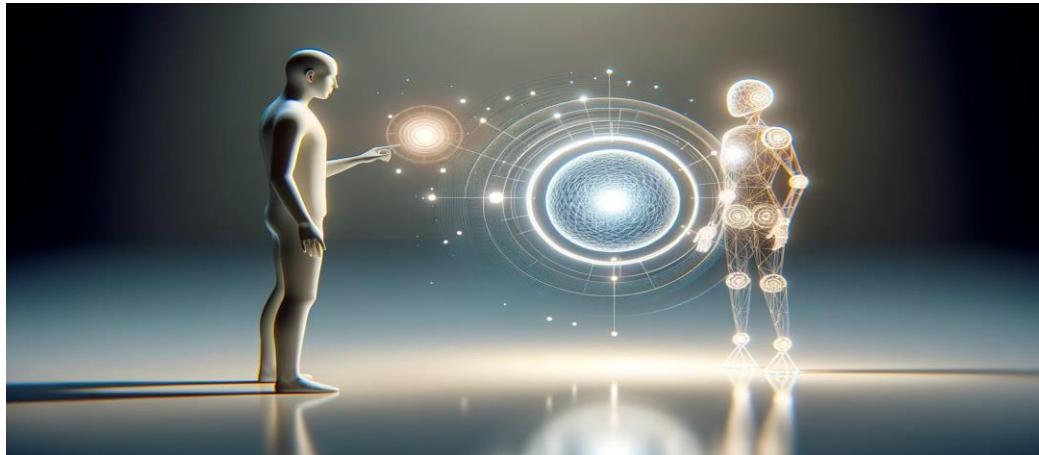
# Goals Of ISEA Web Sessions

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1. Stimulate your interests in the intersection of AI/ML, data science, software engineering, and education.
2. Introduce use cases and develop fellows' ability to apply technical skills to solve educational problems.
3. Develop fellows' critical thinking and creativity.
4. Co-construct knowledge and learning among ISEA fellows and instructors.

# A Human-Centered Partnership Model of Education Data Science

- > The human-centered partnership model: people, computer, and domain knowledge interact at every stage of data pipeline to enhance learning opportunity, human decision-making efficiency, and organization performance, and system-level equity.



# Human-Centered Data Science Cycle

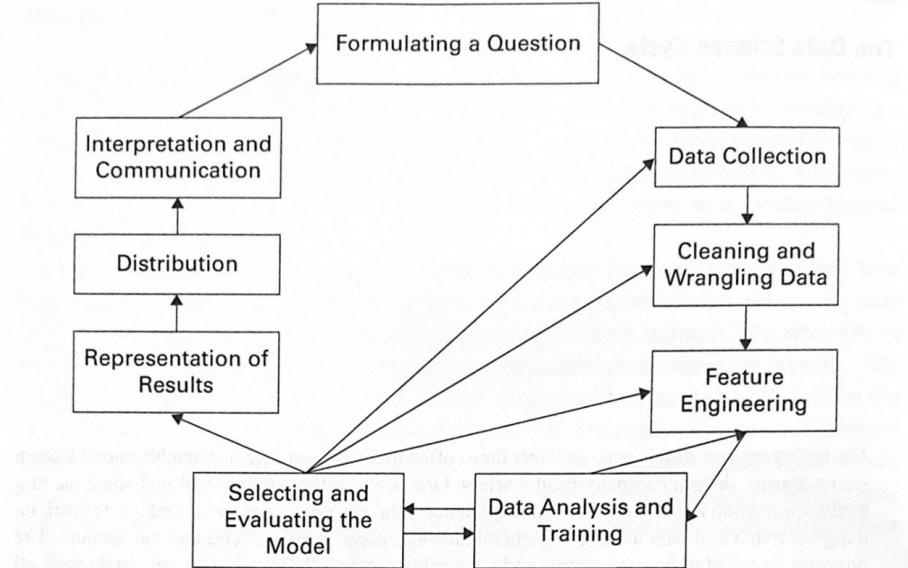


Figure 2.1  
The data science cycle.

Aragon, C., Guha, S., Kogan, M., Muller, M., & Neff, G. (2022). *Human-centered data science: an introduction*. MIT Press. p.14

# Session Overview

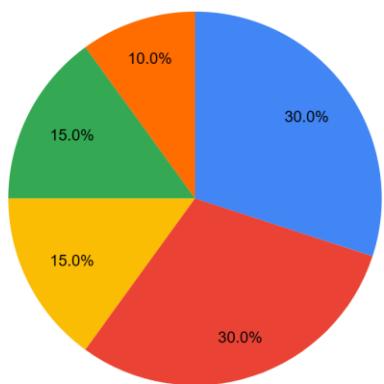
Week	Session Date	Topic
1	1/24/25	Overview of AI/ML in Education
2	1/31/25	Software for Educational Data Mining I
3	2/7/25	Software for Educational Data Mining II
4	2/14/25	Design from a Learning Science Perspective
5	2/21/25	Machine Learning I - fundamentals
6	2/28/25	Machine Learning II - applications
7	3/7/25	Text Analysis I - topic modeling and sentiment analysis
8	3/14/25	Multimodal Data Analysis
9	3/21/25	Causal Inference I - A/B testing and RCTs
-	<b>3/28/25</b>	<b>BREAK</b>
10	4/4/25	Text Analysis II - measuring instructional practices
11	4/11/25	Text Analysis III - teacher learning and RCTs
12	4/18/25	Text Analysis IV - modeling and classification
13	4/25/25	Causal Inference II - quasi-experimental frameworks
14	5/2/25	Economic Evaluation
15	5/9/25	Data ethics and professionalism

# Educational Data Science and AI Training

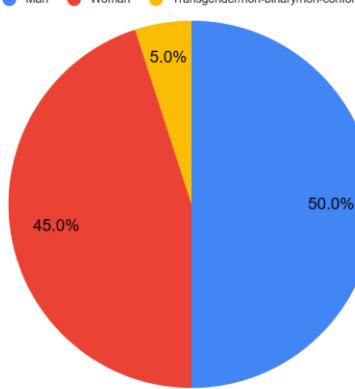
For the second cohort, ISEA attracted **180 well-qualified applicants** across four sectors: Higher education, non-profit think tanks and research institutions, K-12 district and state agencies, and EdTech industries.

Count of Role

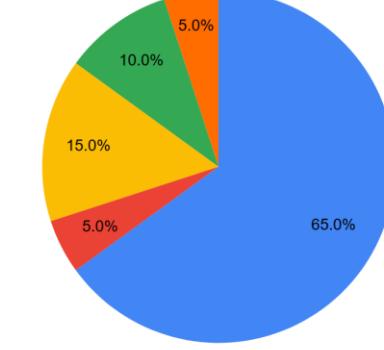
● Data Scientist /Analyst - Industry ● K-12 Educator/Administrator/Analyst - Sch Dist/Pub Sch  
● Researcher in Higher Edu ● Data Scientist /Analyst - State dept ● Researcher in Research Organizations



● Man ● Woman ● Transgender/non-binary/non-conforming



● White ● Asian ● Black or African American ● More than Other Race ● Other



# Fellow Introduction and Break

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- > If you haven't done so already, please share your name, organization, role, and your learning interests in data science in education in the **Slack** space
- > **A small group activity (5 mins)**
  - > Introduce yourself
  - > What drove you to ISEA?
  - > How do you think about the human-centered data science cycle, and how might you use some of the concepts to inform your work?

# Individual Think and Share

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[Use this Link:](#)

1. Which are the three topics you are most excited about?
2. Which are the three topics that are most relevant to your work?
3. Any other topics of interests you wish to discuss?
4. Any recommendations /expectations on teaching styles and methods?

# Hackweek

- > Week of **June 23-27** on the University of Washington campus in Seattle
- > We will share additional details as they're finalized



# Resources

- > **Slack:** Your primary means of communication with those in the program. Feel free to send Lavi a direct message about any program-related issue or question. Feel free to also reach out to your tutors using Slack
- > **Canvas:** Your primary means of managing all the content from the program. Slides and videos will be shared here. Schedules will be updated here (if/when needed)
- > **Github:** This GitHub repository serves as a location for the program-related codes: <https://github.com/ISEA-Repositories/Cohort-2025>

# Program Data Collection

## > Data Collection for IES Reporting

# Homework

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1. Preview next week's materials (will be posted soon)
1. Learning about the basics of python programming and Colab environments:
  - [https://pandas.pydata.org/Pandas\\_Cheat\\_Sheet.pdf](https://pandas.pydata.org/Pandas_Cheat_Sheet.pdf)
  - <https://jakevdp.github.io/PythonDataScienceHandbook/>
  - <https://colab.research.google.com/>
  - <https://www.statlearning.com/>
1. Complete the surveys
  - Survey about your interests (Link in slide #21)
  - [ISEA Pre-Test](#) survey
  - Pre-test of data science knowledge and skills