

Overview of AI/ML in Education and ISEA Logistics

ISEA Session 1

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University of Washington

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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



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Professor in Education, Founder and Co-Director of EPAL



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University of Maryland



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University of Washington College of Education



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University of Maryland



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Assistant Professor

Vanderbilt University



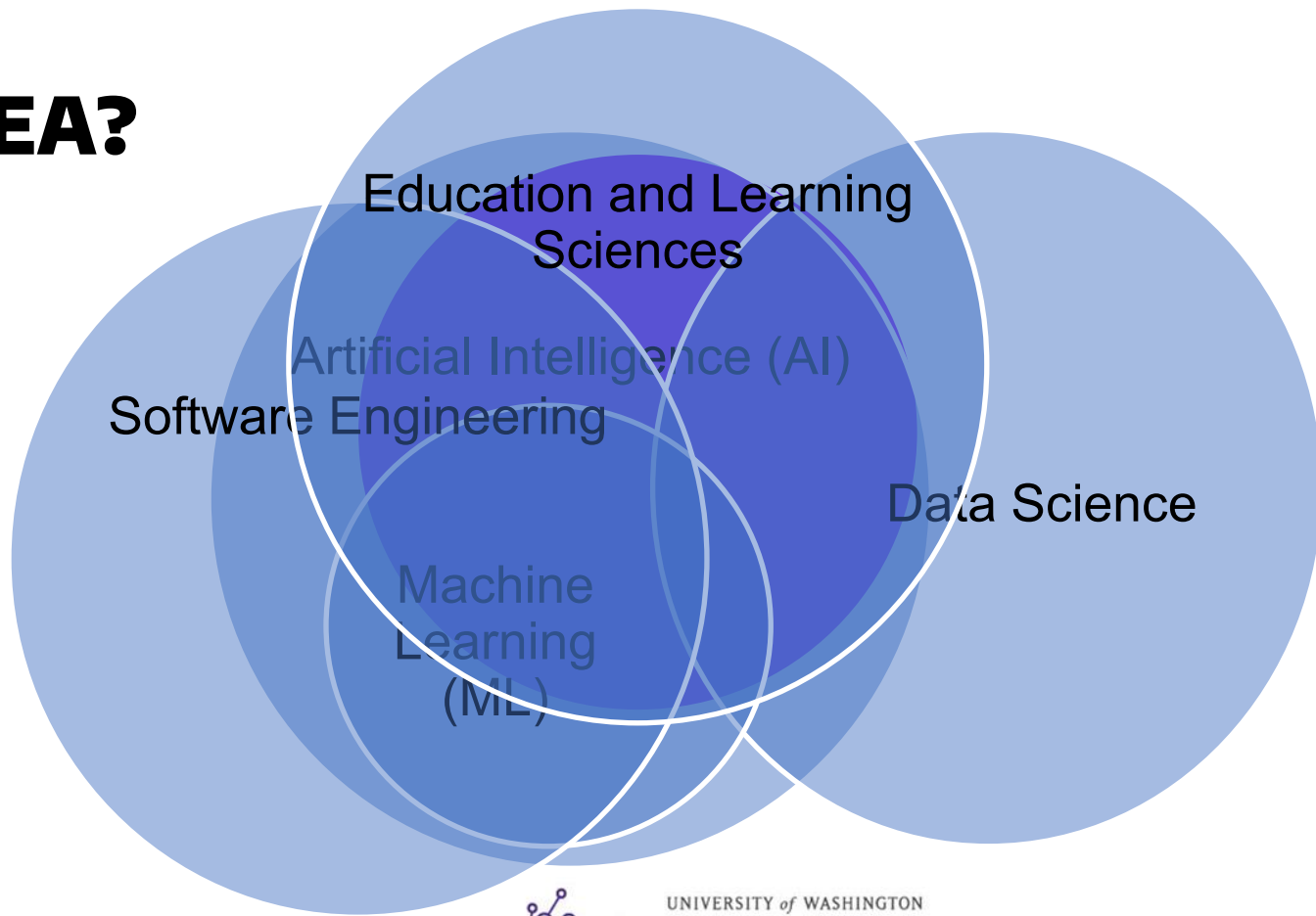
Dr. Shawon Sarkar

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?

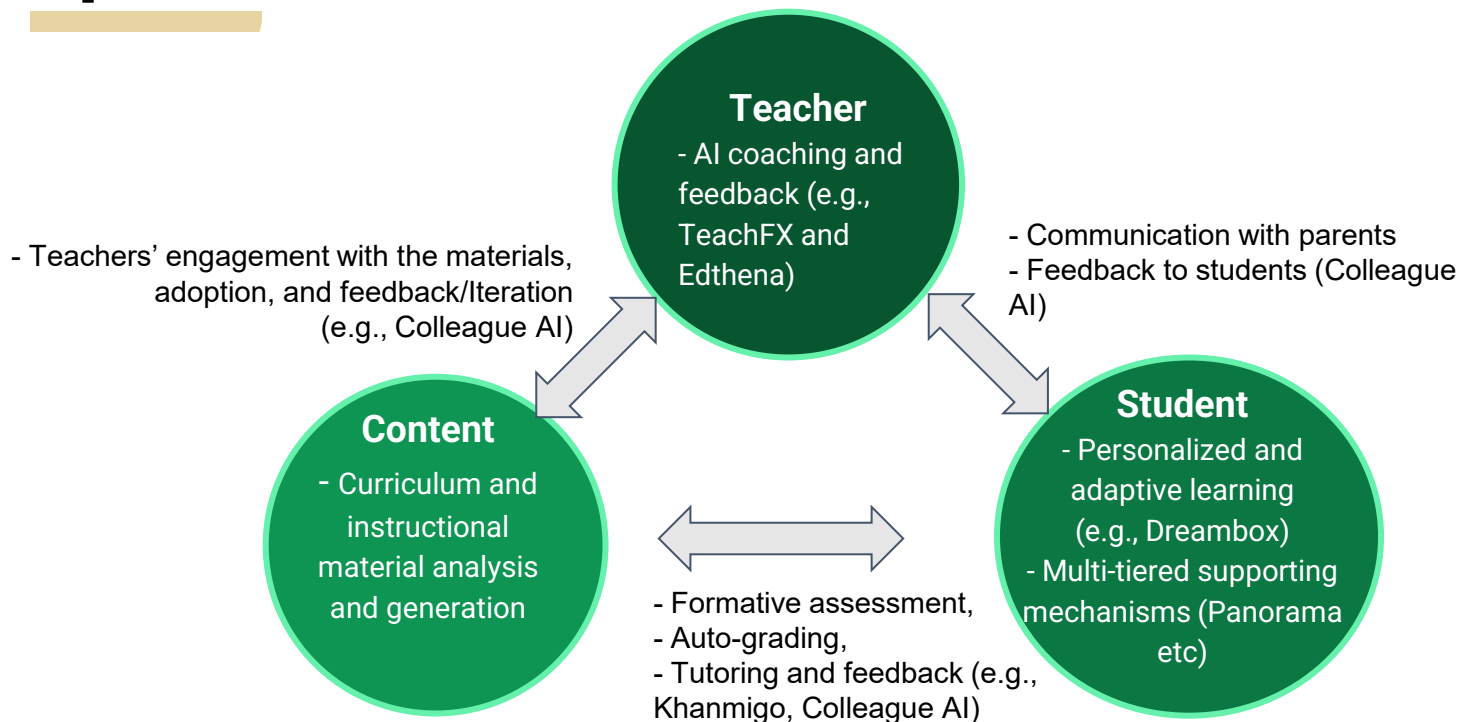
Understanding AI Simply

- > 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:

- > 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



multiply using the associative property of operation

Paragraph

B I U S </> Tt A 

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)

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?




Charlie AI   

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?


Claire AI  

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

Charlie AI   

That's the magic of the associative property, Ch


Claire AI  

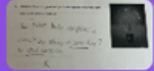
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Example 2: Personalized Learning

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



📄 🔊 ✂️ “ You 



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 ▾

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🎤 Press "Enter" to continue...

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Example 3: Detailed, Individualized Feedback

Two Step Word Problems

Name: _____ Date: _____

DIRECTIONS: Solve the following problems Show how you calculated the answer.

5. Farmer Sam has an apple tree with 148 apples. He collects them all to sell in bags of 10. If 18 apples are rotten and can't be sold, how many bags of apples will there be for sale altogether?

148

-18

130

130

÷ 10

13

Answer:

6. Matt was given \$50 for his birthday. If he buys 4 new baseball caps each costing \$6, how much does Matt have left of his \$50?

50

-24

26

Answer:

7. A basketball team won a game by 22 points and then beat the same team by 12 points in a re-match. The total score of the winning team across both games was 190 points. What was the total score of the team that lost?

22+12=36

190

-36

154

Answer:

8. Elena is swimming in a pool that is 40 meters in length. She has swum 400 meters already and wants to swim another 400 meters. How many lengths will Elena swim altogether?

400

+400

800

800

÷ 40

20

Answer:

Copyright: 2023 @ Kladenegan - Jumping Elephant Math

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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)	Student correctly solved the two-step problem, showing work for 148-18=130 and 130÷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)	Student correctly calculated 4x6=24 and 50-24=26, arriving at the correct answer of \$26.	- Correct multiplication	- Could show the
7. Basketball team score problem	3.OA.D.83	(Strategic Thinking)	Student correctly added 22+12=36, subtracted 36=154, correct points.		
8. Elena's swimming problem	3.OA.D.84	(Extended Thinking)	Student added then 800÷40=20, determined swim lengths		

Overall Score: 13 out of 16

Overall Assessment: The student demonstrated proficiency in solving two-step word problems using various operations. They accurately performed calculations, and arrive at correct answers for subtraction, multiplication, and division.

Comments: Strengths:

- Excellent problem-solving skills across all items
- Consistent in showing step-by-step work
- 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 algebraically and ensuring they include units in their final answers. Keep up the great work!

"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

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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

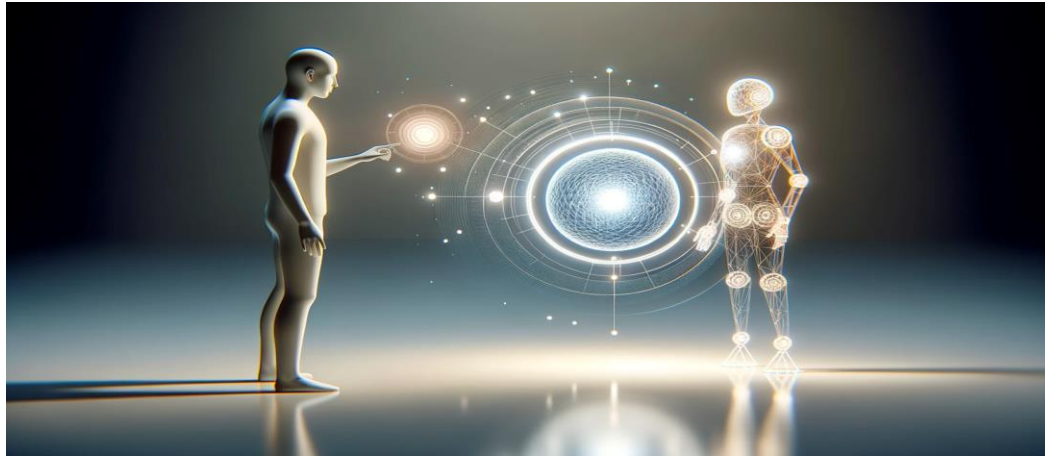
- > **Department of Education AI Guidance**
 - [Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations](#)
 - [Designing for Education with Artificial Intelligence: An Essential Guide for Developers](#)
- > [OSPI's AI Guideline](#)
- > [Council of the Great City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

Goals Of ISEA Web Sessions

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

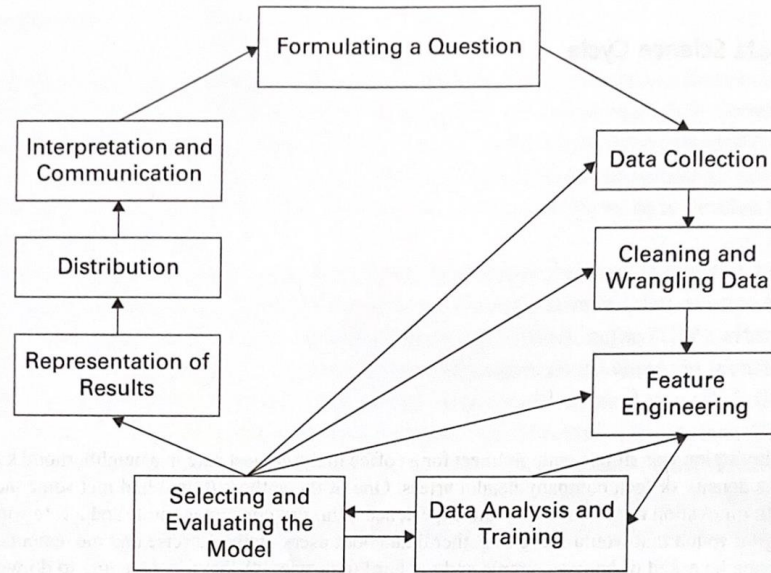


Figure 2.1
The data science cycle.

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

Session Overview

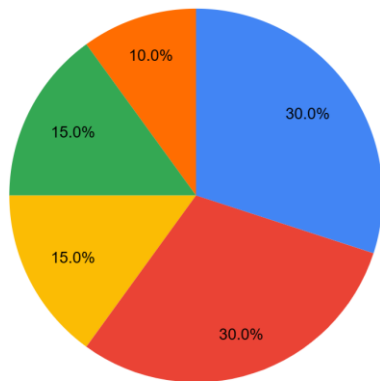
Week	Session Date	Topic
1	1/24/25	Overview of AI/ML in Education
2	1/31/25	Software for Educational Data Mining I
3	2/7/25	Software for Educational Data Mining II
4	2/14/25	Design from a Learning Science Perspective
5	2/21/25	Machine Learning I - fundamentals
6	2/28/25	Machine Learning II - applications
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
-	3/28/25	BREAK
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

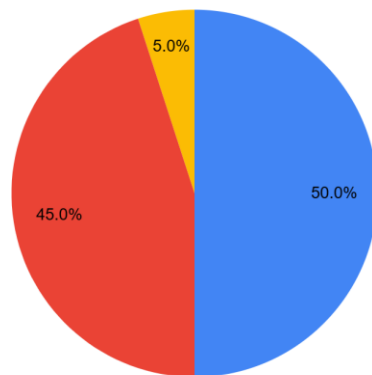
For the second cohort, ISEA attracted **180 well-qualified applicants across four sectors: Higher education, non-profit think tanks and research institutions, K-12 district and state agencies, and EdTech industries.**

Count of Role

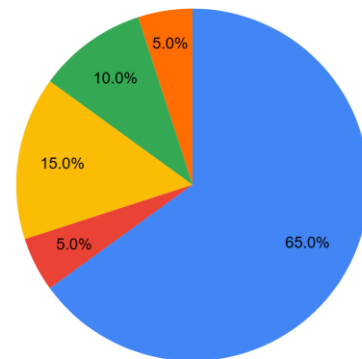
● Data Scientist /Analyst - Industry ● K-12 Educator/Administrator/Analyst - Sch Dist/Pub Sch
● Researcher in Higher Edu ● Data Scientist /Analyst - State dept ● Researcher in Research Organizations



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



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



Fellow Introduction and Break

- > 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

[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

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://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