UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

One Way the Pandemic Improved My Teaching

Spring 2021 Lightning Symposium

Hosted by the Academy for Excellence in Engineering Education (AE3)

March 30, 2021
10:00am

Lightning Symposium Norms

- All participants will be automatically muted upon entry to the Main Room.
- The symposium will consist of:
  - Nine (9) unique presentations of **4 minutes or less**
    - An audible signal will alert presenters when they have 30 seconds remaining and again when time has expired.
- A general Q+A session following all presentations, coordinated by Chris Schmitz (ECE)
- The chat space will remain open during the lightning presentations
- You are encouraged to post questions, share ideas, and offer comments during the presentations; the presenters will not be responding to chat during their 4-minute presentations but rather during the Q+A session following all presentations.
- AE3 staff will monitor for the chat for questions that may be addressed during the open Q+A sessions following all presentations.
- Please raise your hands to ask open-mic questions during the Q+A session.
- The symposium will be recorded and available on the AE3 website (http://ae3.engineering.Illinois.edu) later this week.

Abigail R. Wooldridge
Industrial and Enterprise Systems Engineering
Designing Usable Classes for Connectedness

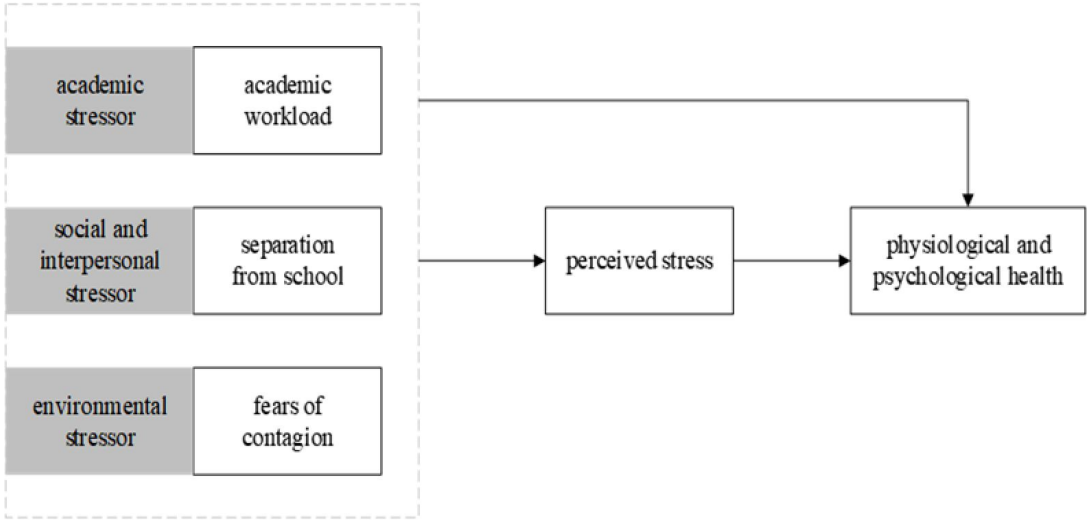
Students report higher levels of stress during the COVID-19 pandemic

(Son et al., 2020; Wang et al., 2020; Yang et al., 2021)

From human factors/ergonomics perspective, stress:

- Is linked with errors and decreased performance.
- Leads to negative health outcomes over time (e.g., increased blood pressure, chronic conditions and burnout) .
- Results from **misfit** between demands (i.e., stressors) and resources.

Redesign for fit to improve student outcomes!



From Yang et al. (2021)

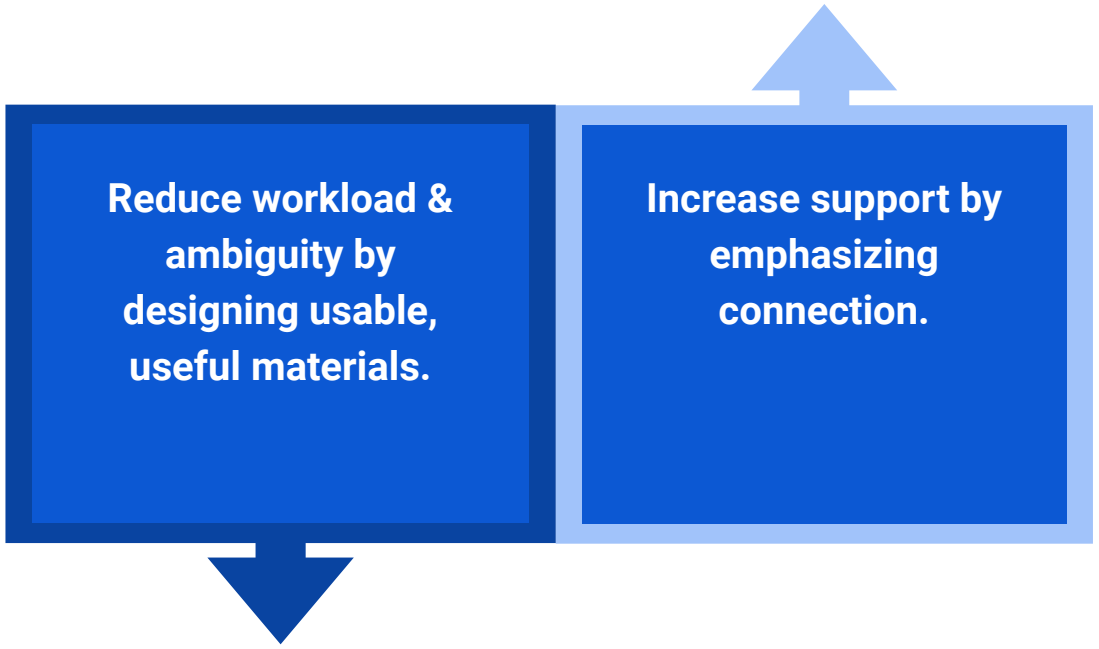
Designing work (classes) to reduce stress

Reduce Stressors

- Workload
- Role ambiguity
- Role conflict
- Interpersonal conflicts
- Supervisory style
- “Job” insecurity

Increase Resources

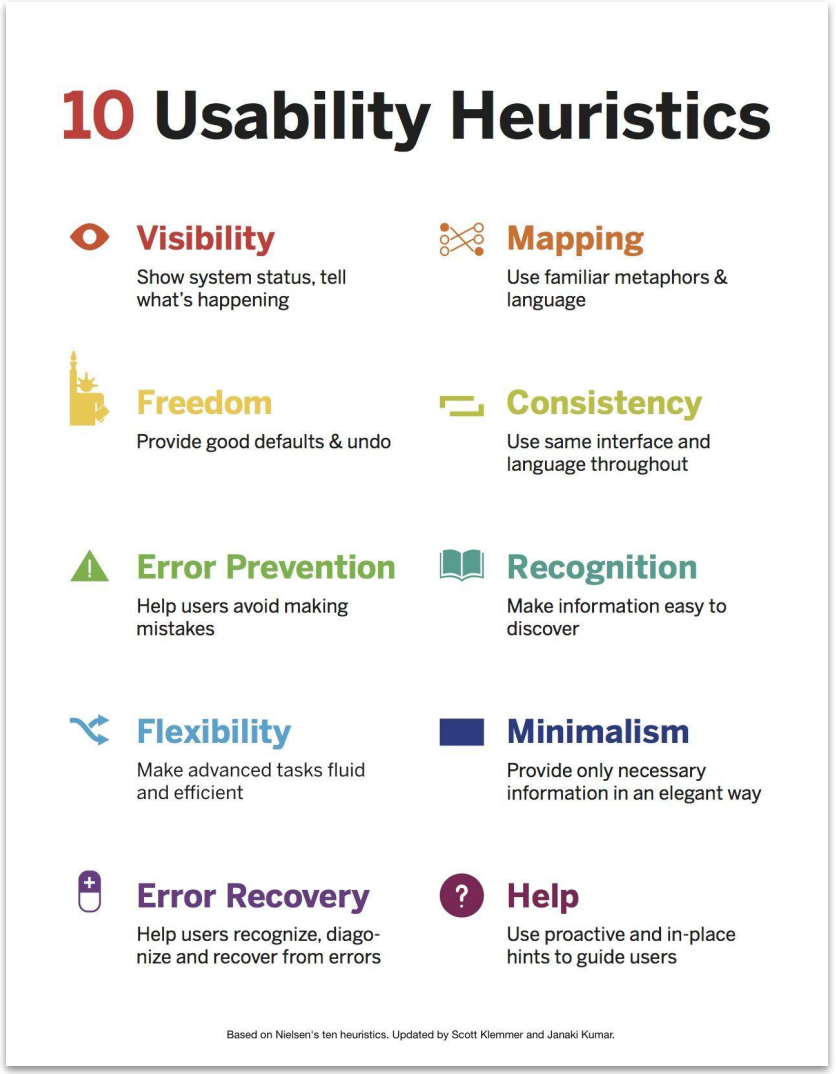
- Job control
- Social support
- Compatible schedules
- Educational resources



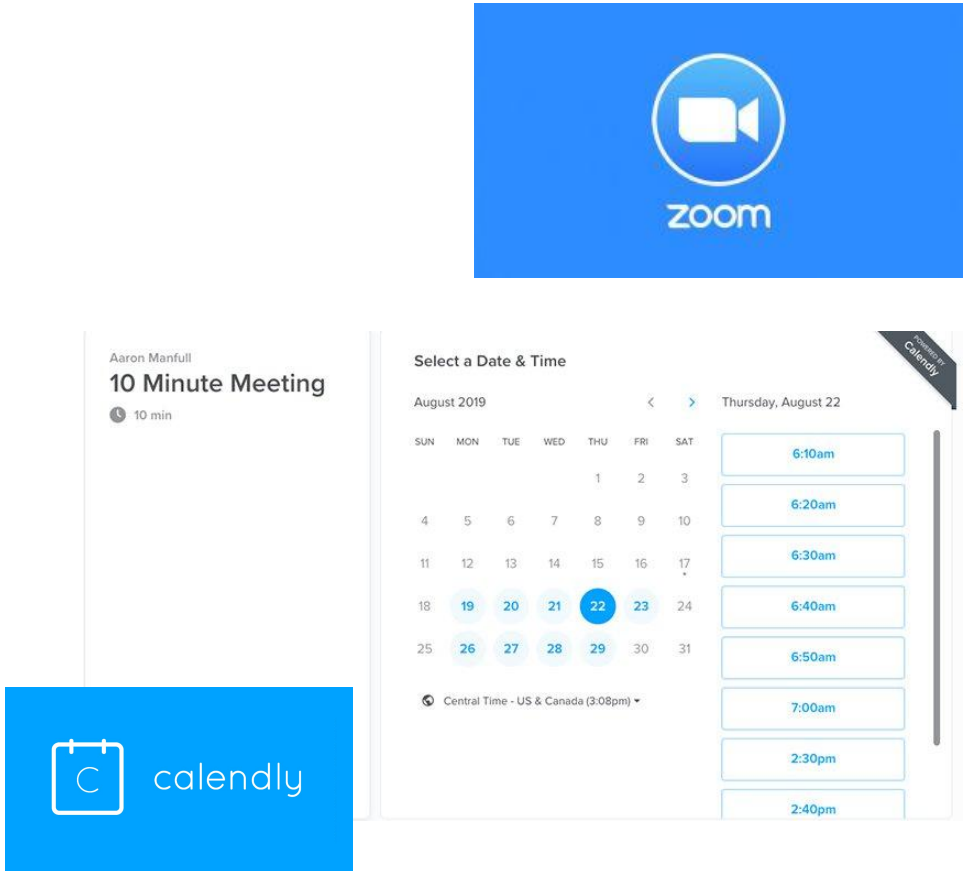
Consider usability heuristics in design of course materials

Special attention to usable calendar:

Consistent due date (everything always due Friday at midnight).
Minimalist with only needed information
Mapping and recognition: organized by week, same format



Supporting connections



Make it easy for students to connect with instructor

Required office hours visit (for points)

Breaks down barriers for some student groups.
Ensures able to join (find room, zoom link).
Supports tailoring materials to student interests

Optional office hours visits (for extra credit)

Incentivizes ongoing dialog.
Reduces stress related to grade.
Small but appreciated.

New: use Calendly for scheduling due to conflicts

Increase access (in controlled way).
Reduces my workload!

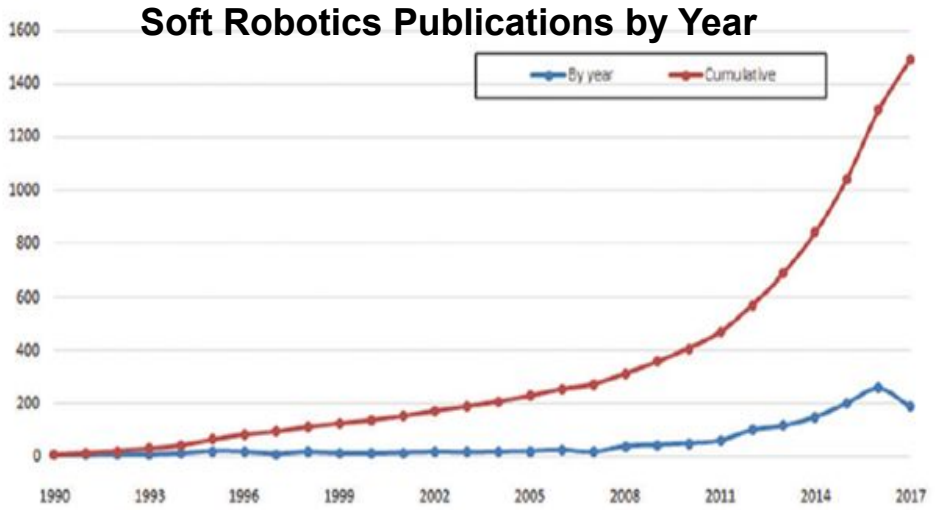
Holly Golecki
Bioengineering
Leveraging Virtual Open Access Science

BIOE498/598 Soft Robotics

Course Resources:

- Relatively new field
- Utilizes journal articles as course text

- Soft Robotics Toolkit: a collection of resources from practitioners across the world

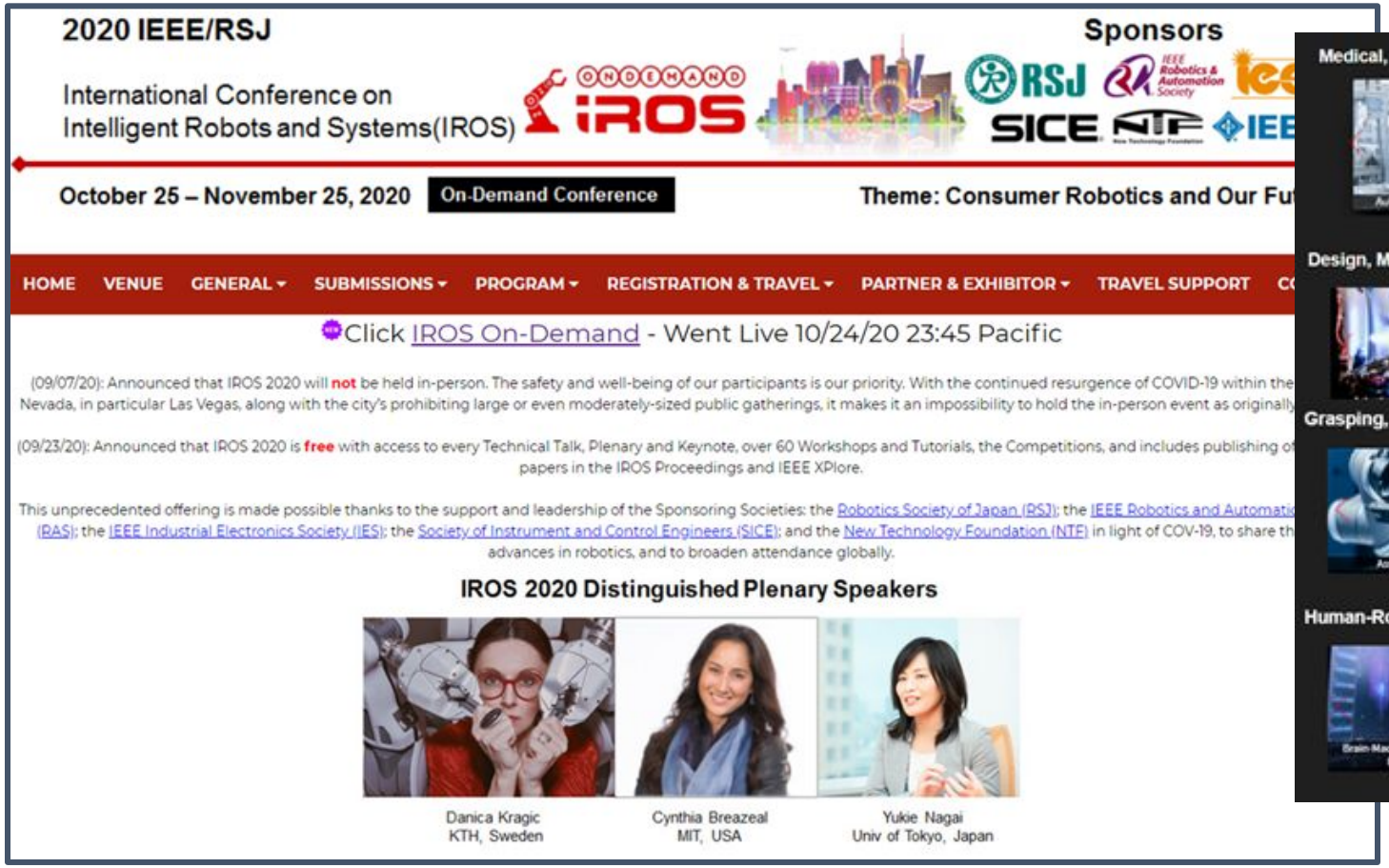


The pandemic changed two things:

1. **“Zoom” became second nature**
2. **More of science became “open access”**

Many Conferences were *Virtual* and *Free*

→ **This allowed my students to interact with the most cutting-edge information in bioinspired robots and healthcare applications**



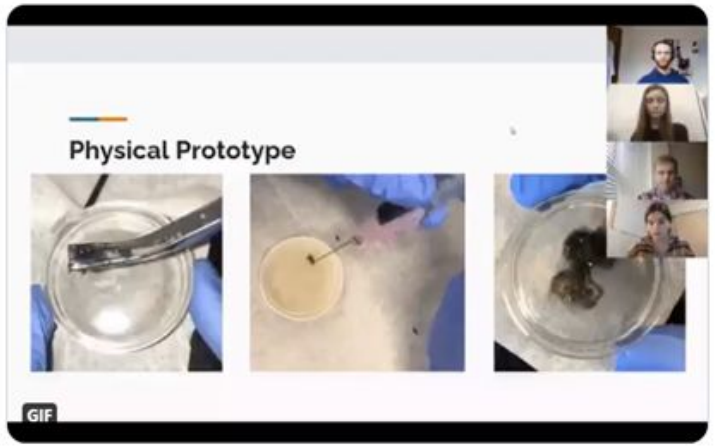
This applied in BIOE435 Senior Design, too

→ Any barriers to contacting experts in the field were completely removed and opportunities to present at conferences were free and accessible.

AIChE Regen Eng Society Symposium

Illinois BIOE
@BIOENGatIL

#Bioengineering #seniordesign students, Maddie Blaauw, Brendan Brasch, Caroline Fatina & Jarron Roy, will be presenting their improved 3D #Bioprinter project at the @ChEnected Regenerative Engineering Society Symposium today. This project is sponsored by prof. @Underhill_UIUC



FRESH Bioprinter

RESEARCH ARTICLE | BIOMEDICAL ENGINEERING

Three-dimensional printing of complex biological structures by freeform reversible embedding of suspended hydrogels

Thomas J. Hinton[1], Quentin Jallerat[1], Rachelle N. Palchesko[1], Joon Hyung Park[1], Martin S. Grodzicki[1], Hao-Jan Shue[1], Mohamed H. Ramadan[2], Andrew R. Hudson[1] and Adam W. Feinberg[1,3,*]

[1]Department of Biomedical Engineering, Carnegie Mellon University, Pittsburgh, PA 15213, USA.
[2]Department of Chemistry, Carnegie Mellon University, Pittsburgh, PA 15213, USA.
[3]Department of Materials Science and Engineering, Carnegie Mellon University, Pittsburgh, PA 15213, USA.
*Corresponding author. E-mail: feinberg@andrew.cmu.edu
– Hide authors and affiliations

Science Advances 23 Oct 2015:
Vol. 1, no. 9, e1500758
DOI: 10.1126/sciadv.1500758

Looking Ahead..

Conferences won’t always be free, or even online, but we will have this new agility with connecting online that we can leverage to enhance our students’ engagement with practitioners, cutting-edge results, and opportunities in our fields.

Michael R. Nowak
Computer Science
Interactive daily lessons in CS-128

Motivation

Not only "***how can I teach better during the pandemic***", but "***how can I use this as an opportunity enhance my student's experience for once we are back to normal***"

Acknowledge Student Outside Responsibilities

Maintain Student Attention

Enhance Student Engagement

Interactive daily lessons in CS-128

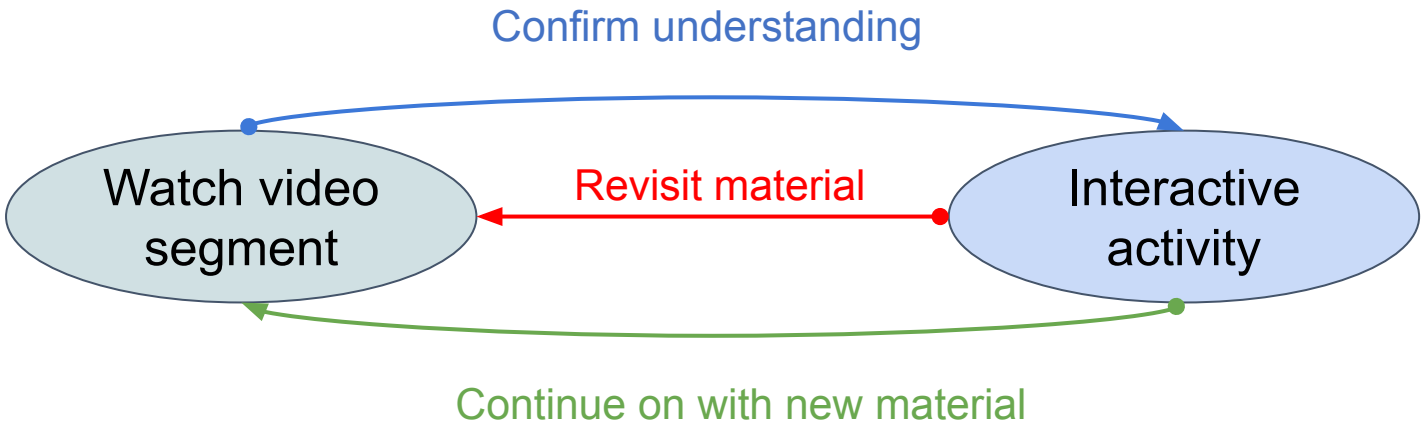
Students are exposed to **new material each day** through video and have an **opportunity to practice what they've learned** through our **interactive coding exercises**

On-demand

20-30 minutes of video content

Divided into short video segments

Side-by-side with interactive coding exercises



Parting thoughts

Interactive daily lessons are **more focused than traditional lectures**, while providing an **engaging mix of content and assessment** each day!

They provide **enhanced accessibility**, especially to nontraditional students

Their production takes dedication and careful planning

- It's difficult to get the time-boxing correct and sometimes lessons run longer than expected
- Likewise for the video segments
- Interactive activities take additional time to develop too

I do not plan to return to the lecture model post pandemic

Wayne Chang
Mechanical Science and Engineering
Standardizing computing platform across engineering courses

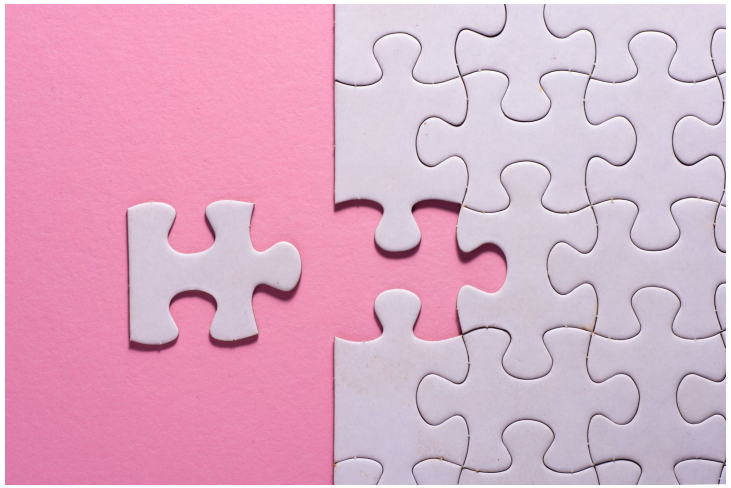
Pandemic Lessons

“Less is More”

- ➔ How does one keep up with ever growing and evolving variety of numeric computing platforms?
- ➔ Will commercial software always be available?
- ➔ Jack of all trades?

“Connectedness is the Essence of Everything”

- ➔ How do we optimize the role of prerequisites?
- ➔ Do students see the benefits of fulling prerequisites?
- ➔ Are students overwhelmed by the variety of tools and platforms used between classes?



Mohd Azri Suratmin / EyeEm / Getty Images

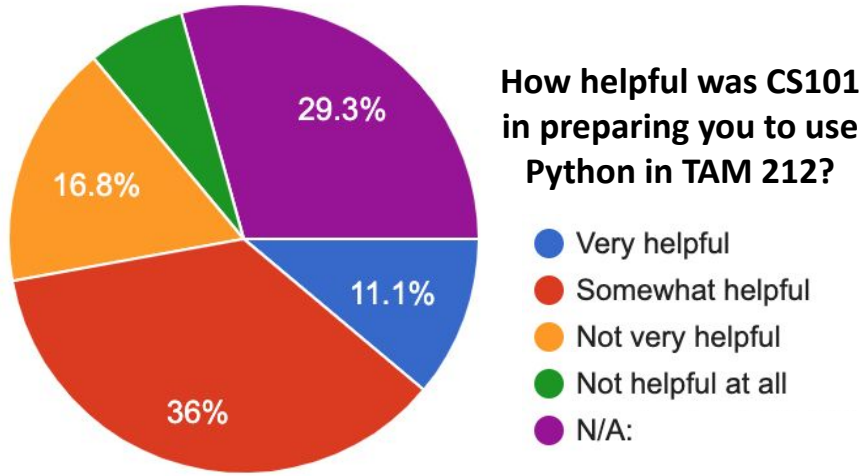
Dilemma: Defining Standards in Engineering Curriculum

- ➔ TAM 2xx (210/211, 212, and 251) courses has been functioning as a community of teaching, and students benefited greatly from standardized course policies for all TAM 2xx courses
- ➔ The necessity of numeric computation has been a point of contention for both faculties and students
- ➔ Commercial software (e.g. MATLAB) availability has been inconsistent in recent years
- ➔ What are other classes doing?

Collaboration with CS101 to Incorporate Python into TAM 2xx

- ➔ Python is the primary programming language in CS101
- ➔ Computation labs in Math 257 uses Python
- ➔ PrairieLearn has integrated Python workspace
- ➔ CS101 course resources are made available to TAM 2xx students as Python refreshers
- ➔ TAM 2xx will be involved in CS101 course redesign

Invitation: how can TAM 2xx better serve your course?



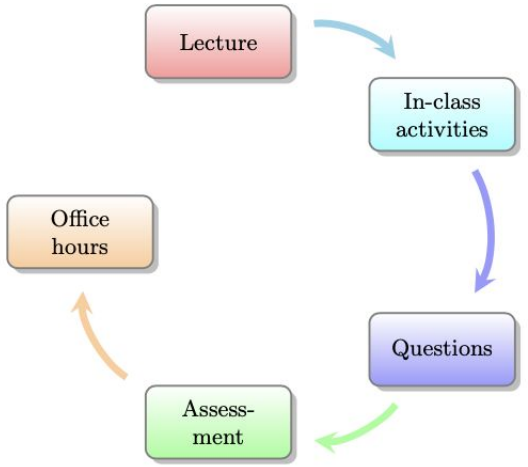
Chrysafis Vogiatzis
Industrial and Enterprise Systems Engineering
Diverse delivery modes for flipped classrooms

Before and after the pandemic

Spring 2020 → Fall 2020

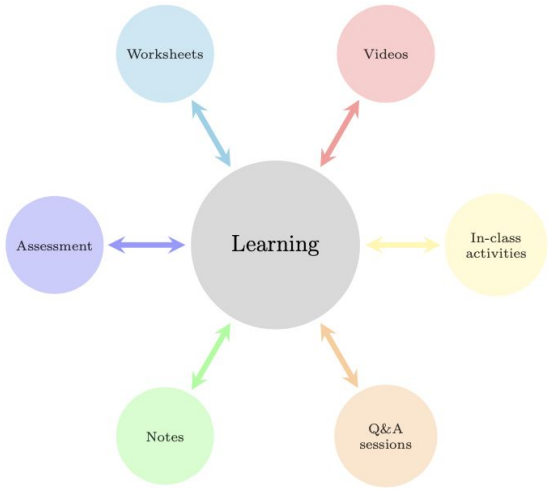
Before the pandemic:

- almost sequential order of activities per topic.
- had bought into active learning; still the majority of time was spent *lecturing*.

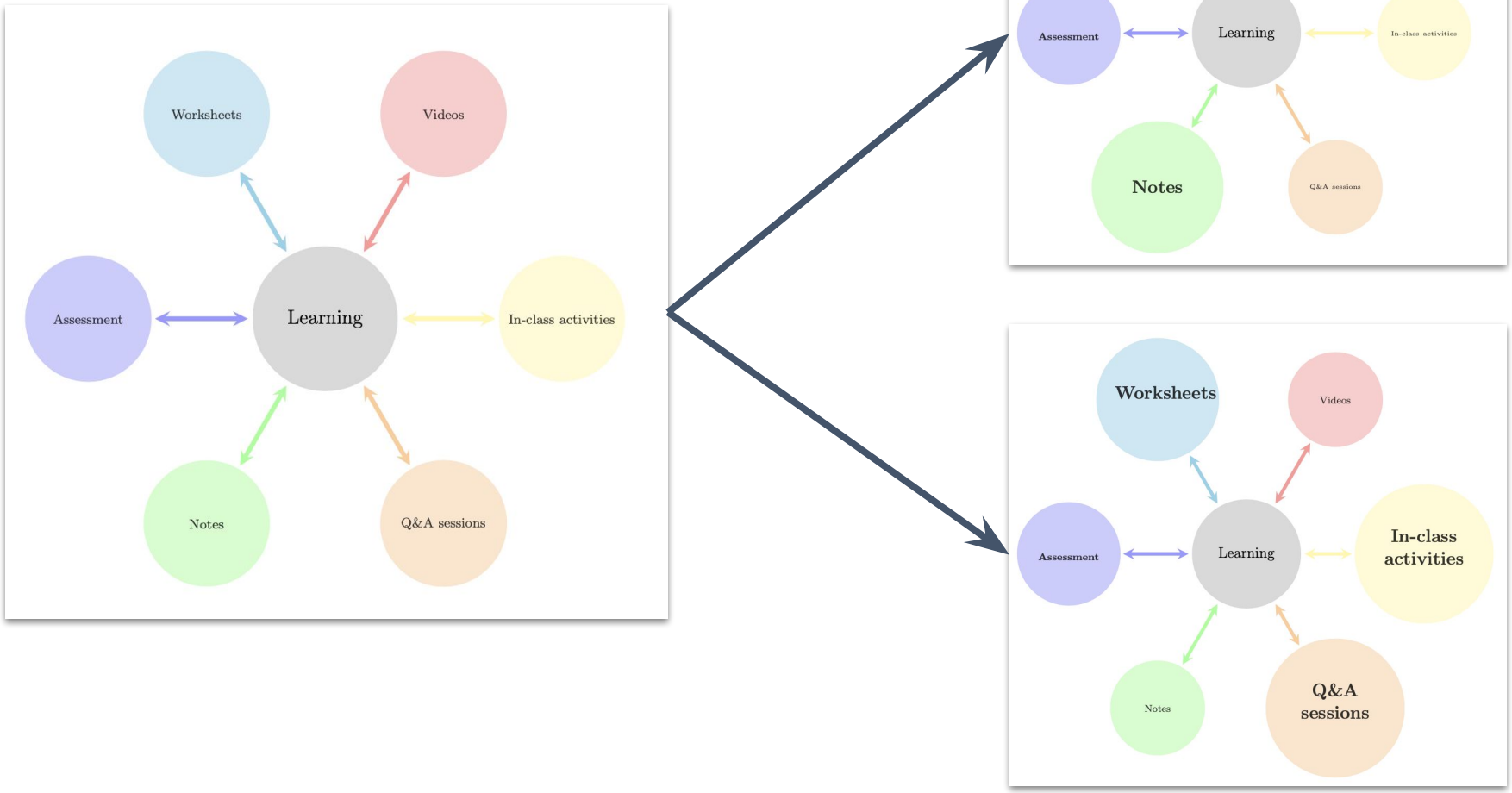


After the pandemic:

- total redesign of IE 300.
- flipped classroom; multiple “low-stake” assessments; group work during class; small duration pre- and post-lecture videos; extra Q&A sessions.
- **multiple modes of content delivery.**

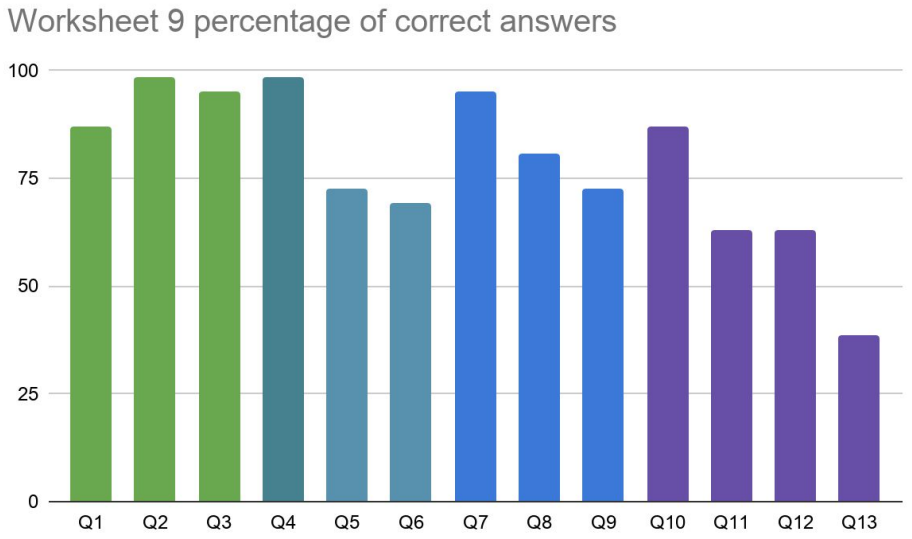


Diverse modes

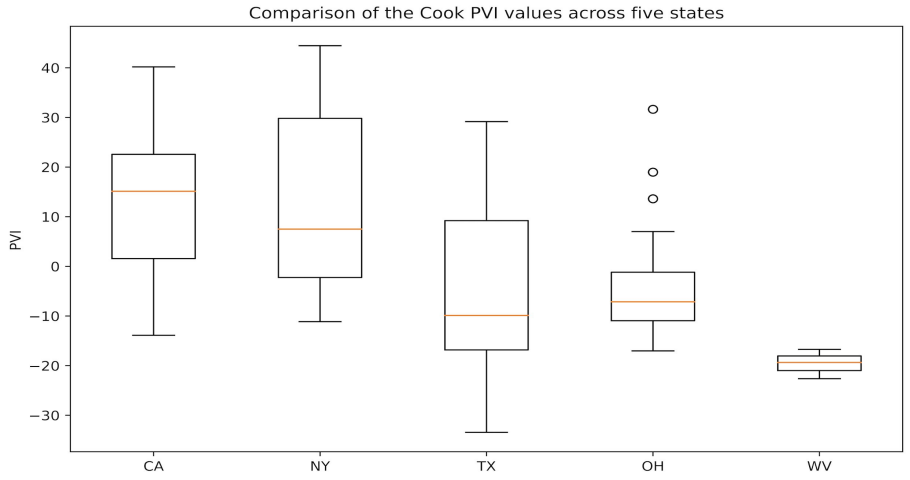


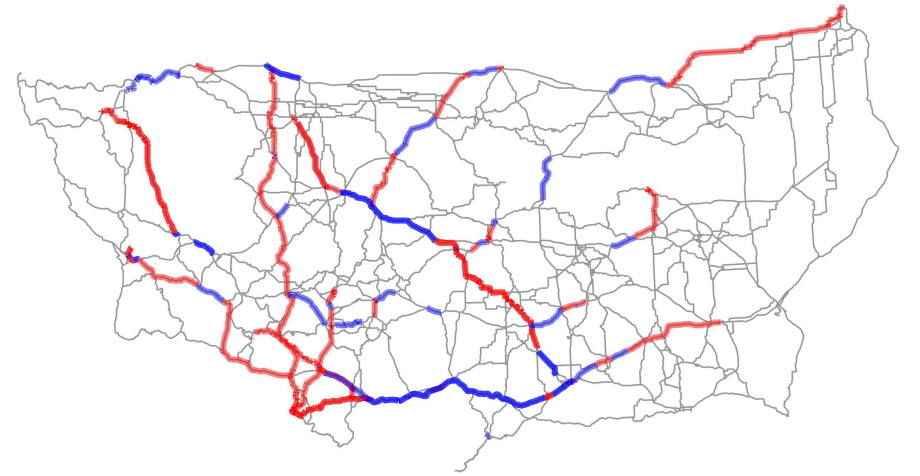
Worksheets: process and feedback

- Students receive the worksheet an hour before class, and have to submit it after class.
  - Completed or not! Submission is worth points; correctness is not (at this point).
- The teaching assistants and myself correct the worksheets and collect information on “problem areas”.
- Allows for *personalized student feedback* (through gradescope).
- Also provides me with feedback!
  - For Q&A sessions; for office hours discussions; for Piazza posts; for extra activities.



Just-in-time teaching





Feedback + Questions

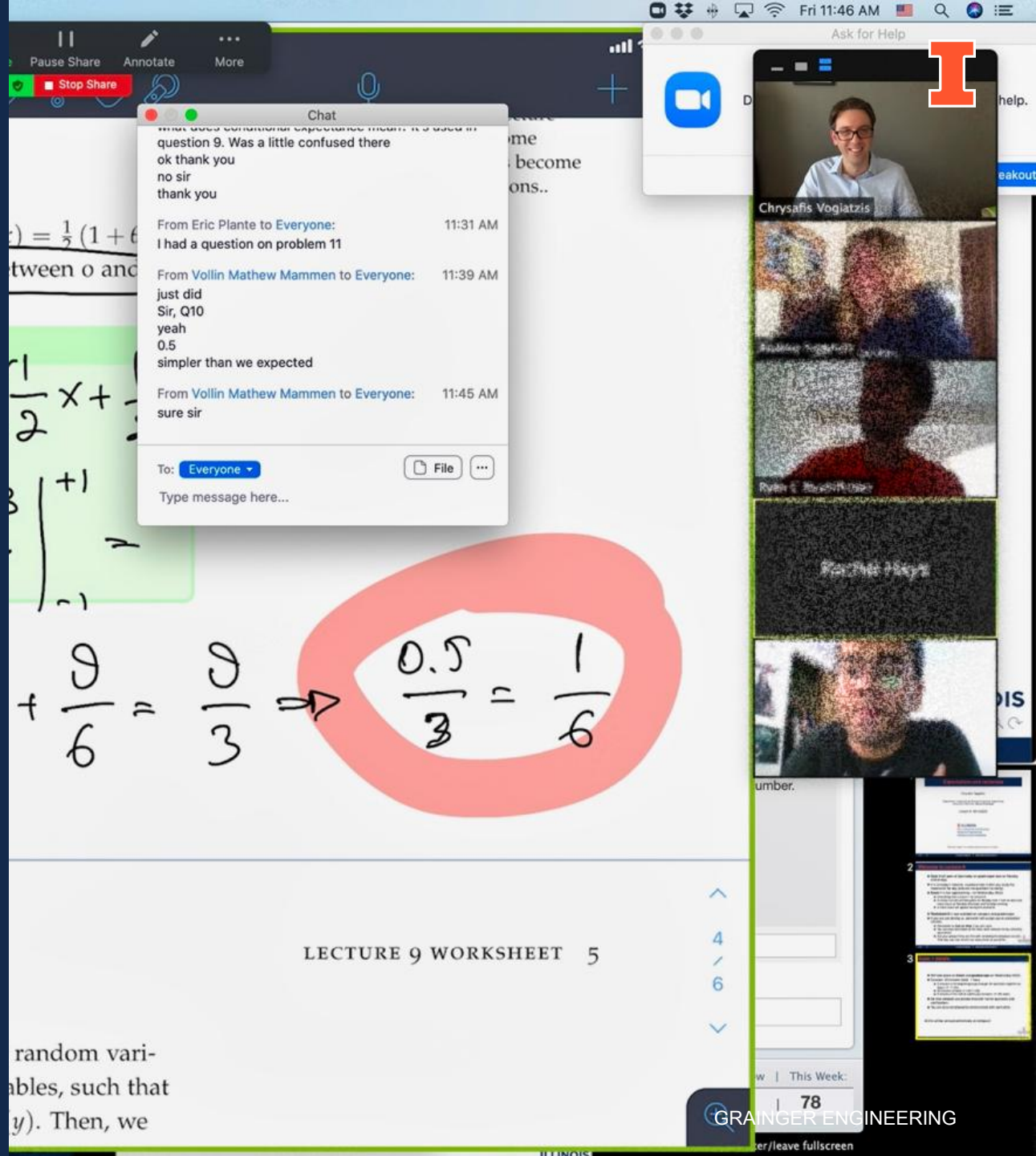
Based on the feedback provided to students, and based on the questions received by students (in office hours and on Piazza):

- We schedule more or fewer synchronous activities.
- We provide extra exercises/notes/post-lecture videos.
- We “synchronize” by doing extra Q&A sessions.

We also assign just-in-time assignments!

Tools used

- Gradescope
- ClassTranscribe
- Piazza
- Compass
- gather.town



Abdu Alawini
Computer Science
Synchronous Group activities on Prairielearn

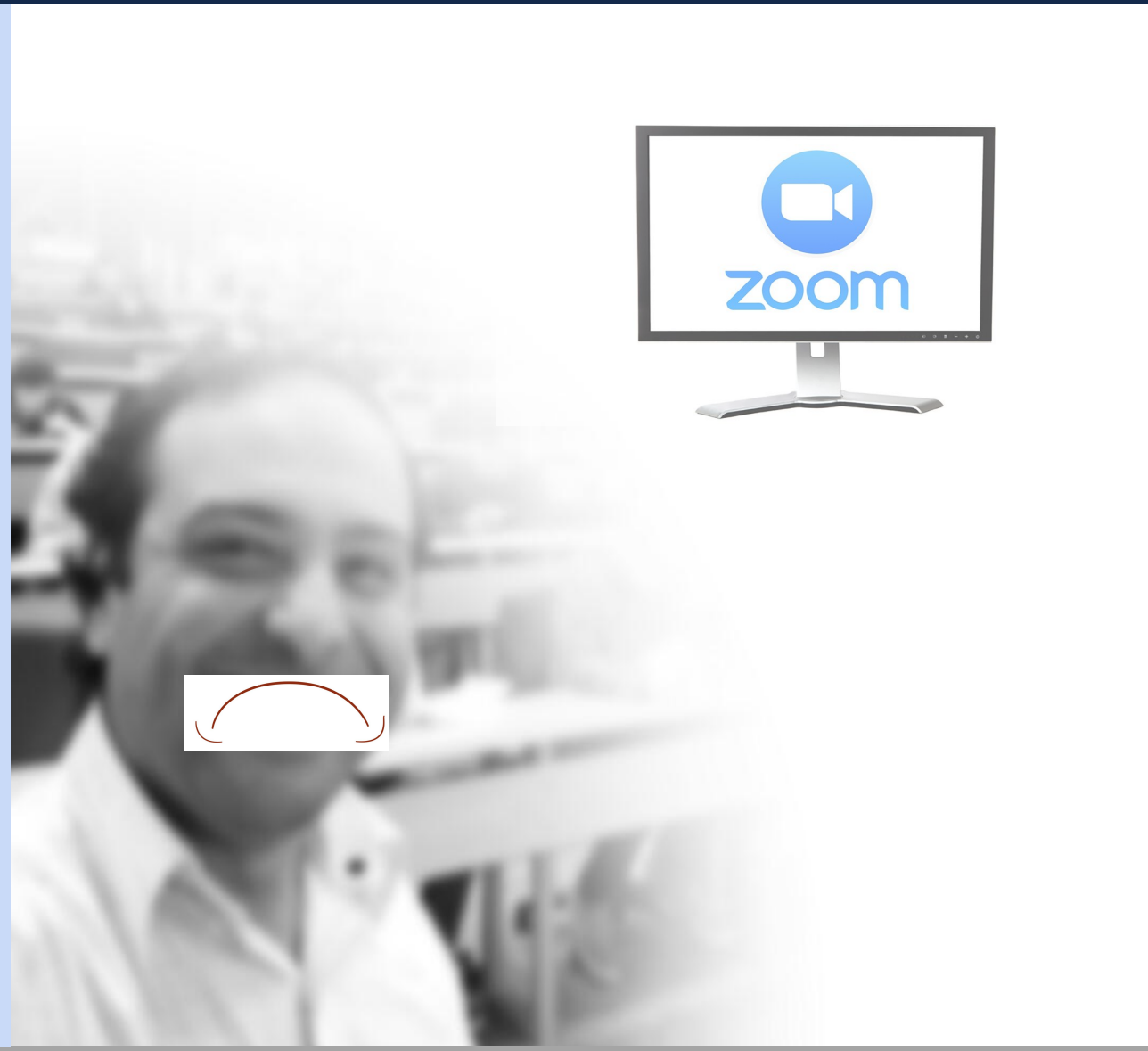
CS411 structure before the pandemic

- Class meeting time:
  - 80% lecture
  - 20% iClicker activities
- Semester-long Group project
- Homework assignments

Call for action!

- **Hard to lecture to a laptop monitor**
- **Students couldn’t connect with their classmates**
- **A significant increase in the number of team communications issues reported**

How can we build the support communities students had before the pandemic?



Prairielearn Group Assessments

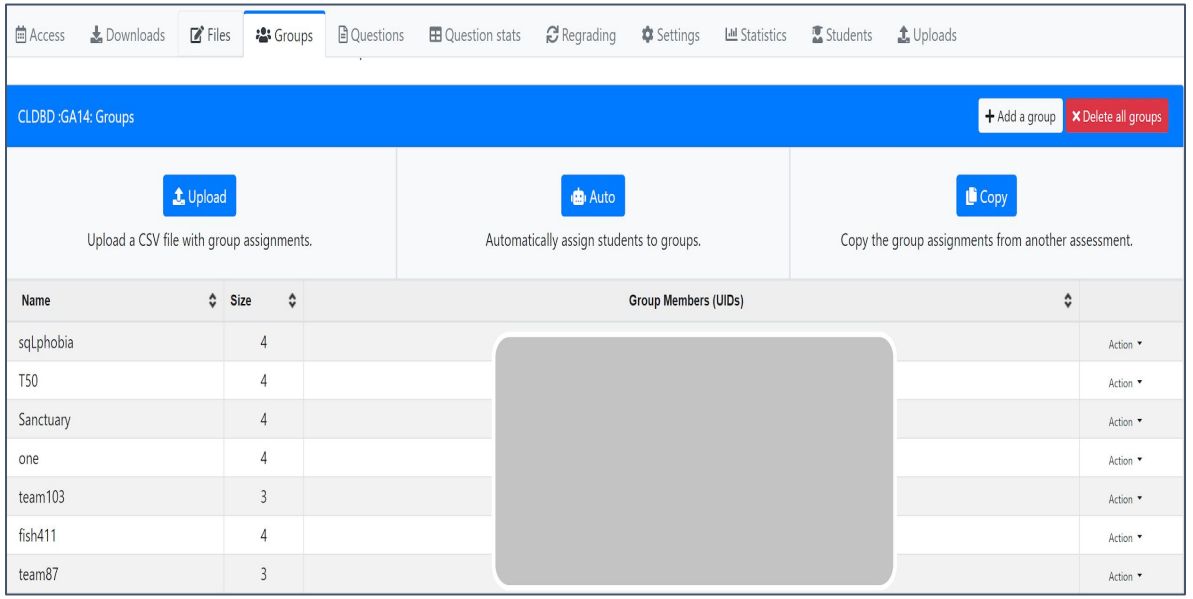


Summer of 2020: Prof. Silva et al. led the development of collaborative assessments on Prairielearn

Group work features:

- Students can create/join/leave teams
- Instructors can assign students to teams
- Students work collaboratively on assignments
- All team members receive the same grade

SQL-PRE1	Introduction to the Relational Model
SQL-PRE2	Basics of SQL
SQL-PRE3	Advanced SQL: Multi-Relation (JOIN) Queries
SQL-PRE4	Advanced SQL: Subqueries and Set Operations
SQL-PRE5	Advanced SQL: Grouping, Aggregation and Views
SQL-PRE6	Advanced SQL: Database Updates and Stored Procedures
SQL-PRE7	Advanced SQL: Constraints and Triggers
SQL:GA1	Group Activity 1: Basics of SQL
SQL:GA2	Group Activity 2: Multi-Relation (JOIN) Queries
SQL:GA3	Group Activity 3: Subqueries and Set Operations
SQL:GA4	Group Activity 4: Advanced SQL Queries (Aggregation and Grouping)
SQL:GA5	Group Activity 5: Updates and Stored Procedures
SQL:GA6	Group Activity 6: Constraints and Triggers



Synchronous Group Activities on Prairielearn

Before Class

- Students watch a pre-lecture video (20-30 minutes)
- Take a 5-minute quiz
- Can ask questions on Campuswire

During Class

- *First 45 minutes*
  - Work with a team of 4 on exercises related to the pre-lecture
- *Last 30 minutes*
  - Instructor solve problems related to the group activity, and
  - Answer students' questions

Synchronous Sessions

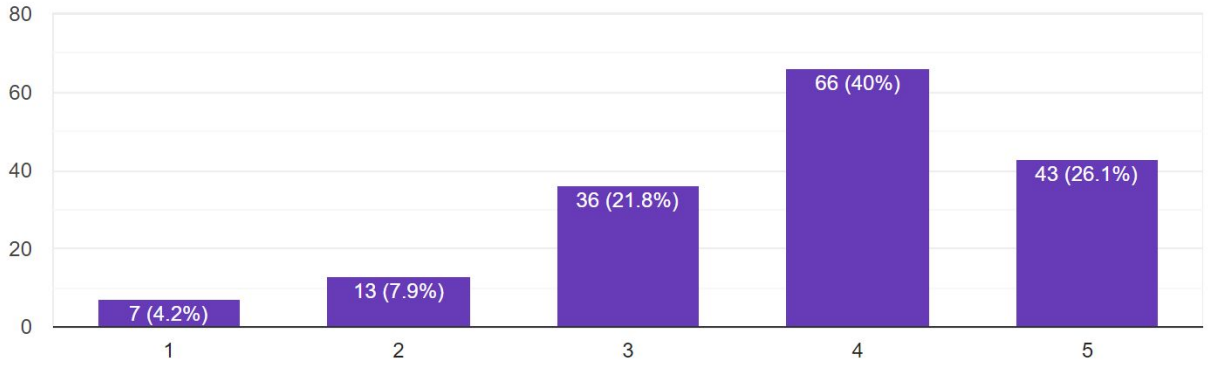
- Attendance required
- Two Zoom meeting to have enough breakout rooms for 400+ students
- Queue@illinois for managing help requests
- CAs + TAs help with managing the session and answering questions

Promising Early Feedback

Spring 2019

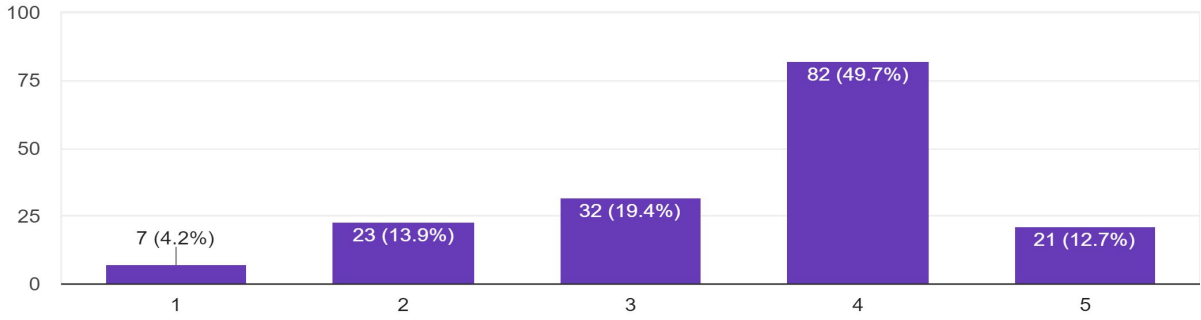
In-class iClicker questions and discussion have helped me learn?

165 responses



How well do you understand advanced SQL queries (i.e., JOINS, Subqueries, Grouping and Aggregration) ?

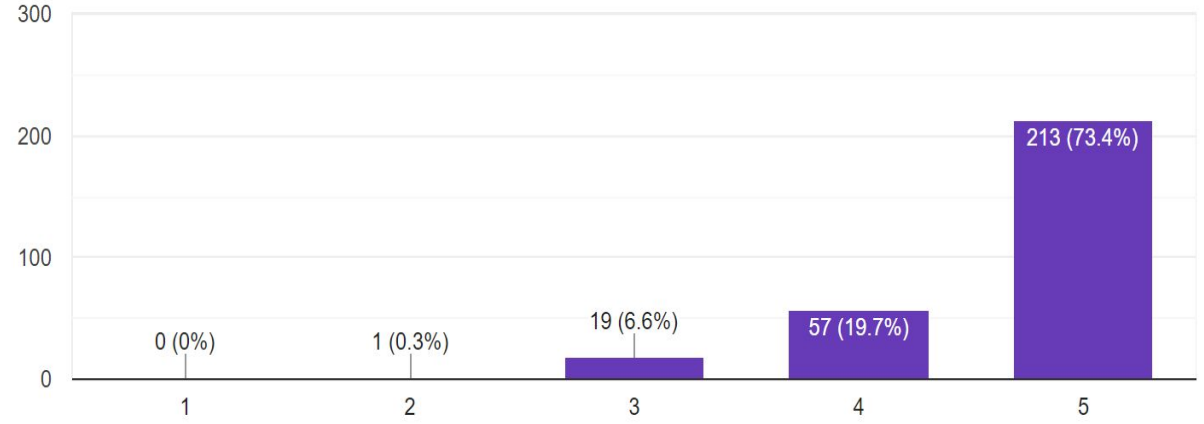
165 responses



Spring 2021

Group Activities have increased my understanding of course concepts.

290 responses



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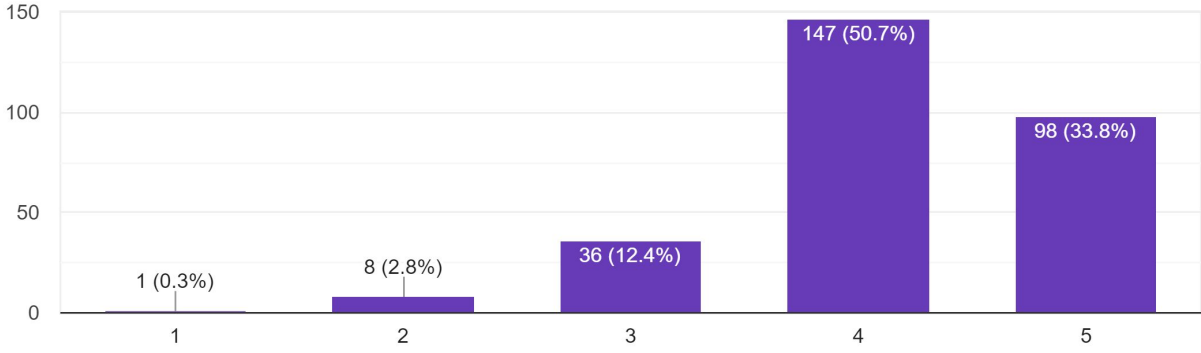
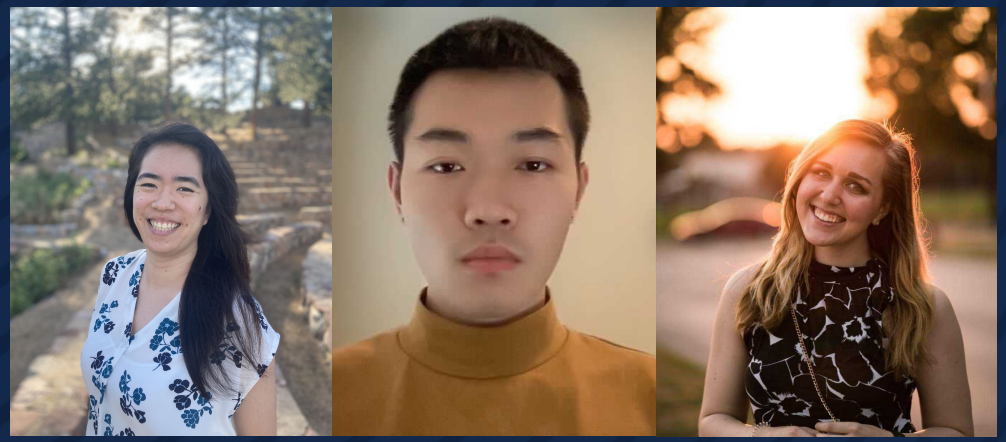
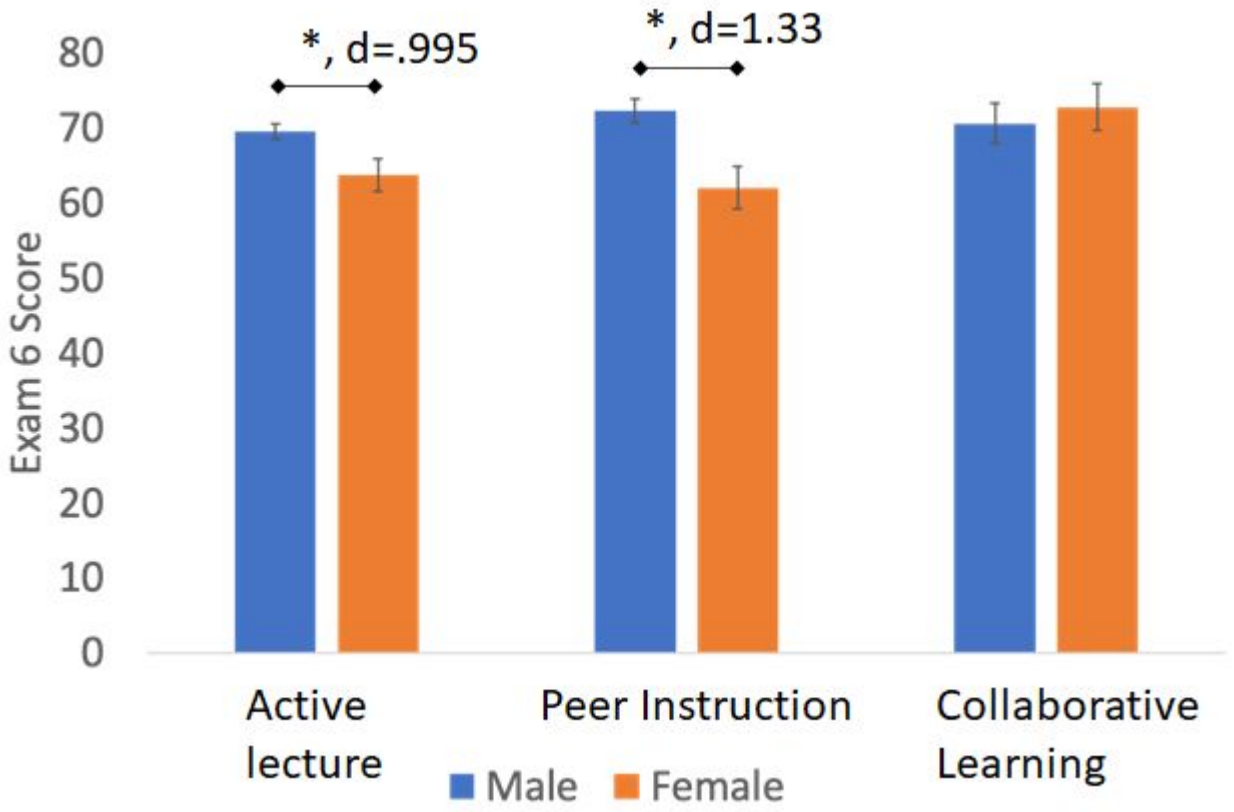
290 responses

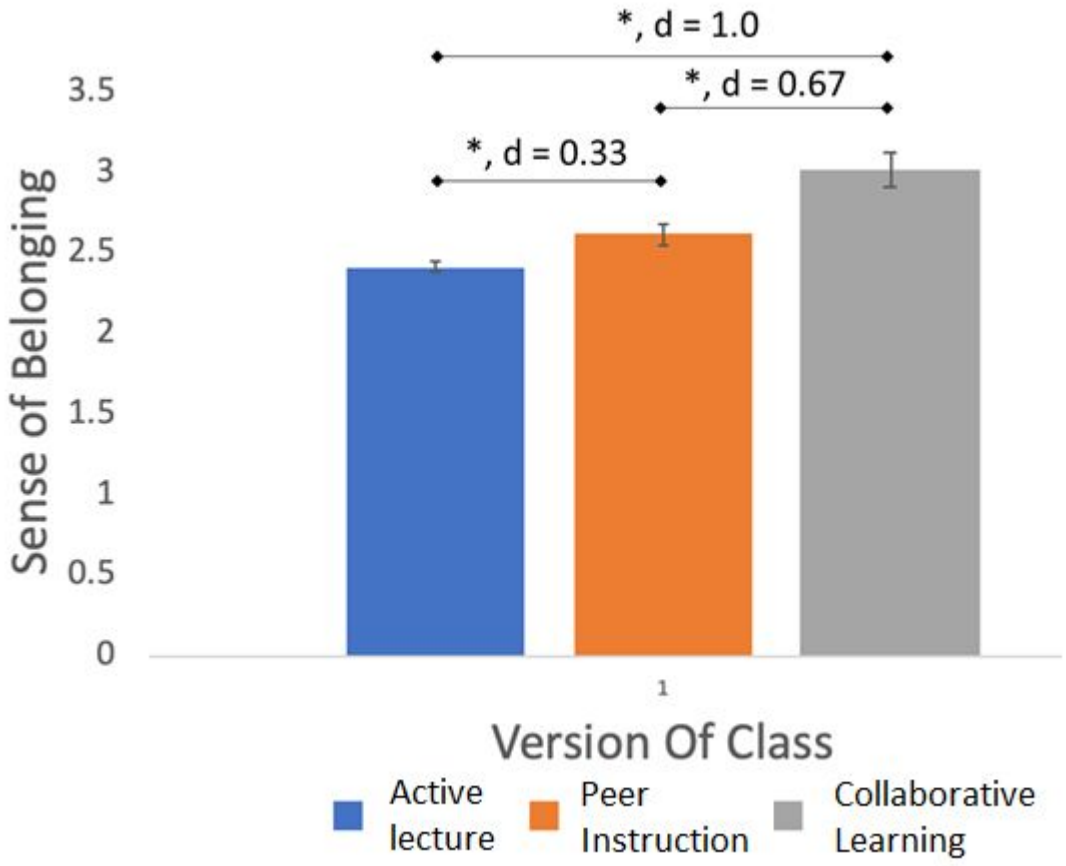




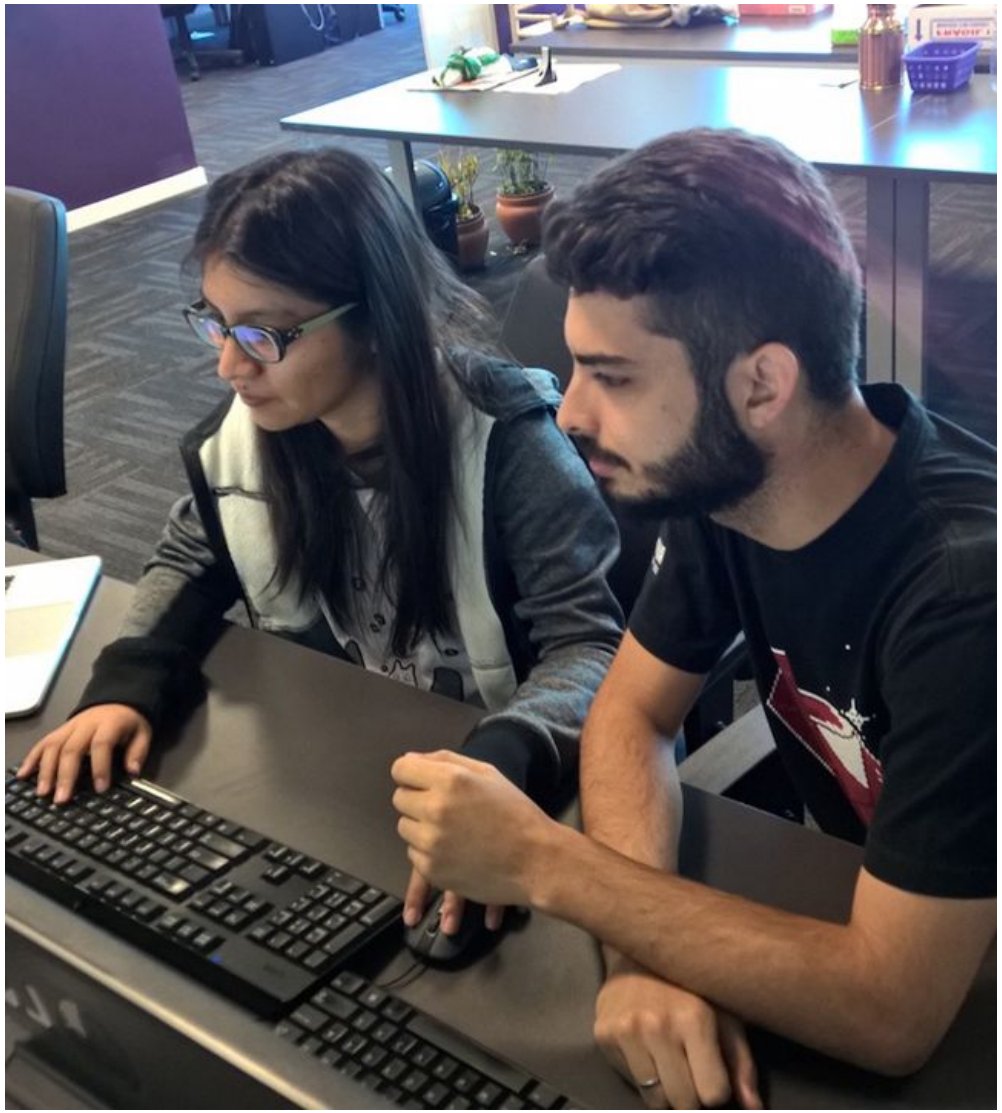
Geoffrey Herman
Computer Science
Group activities with assigned roles

Closing gender gaps, improving climate





Group Roles

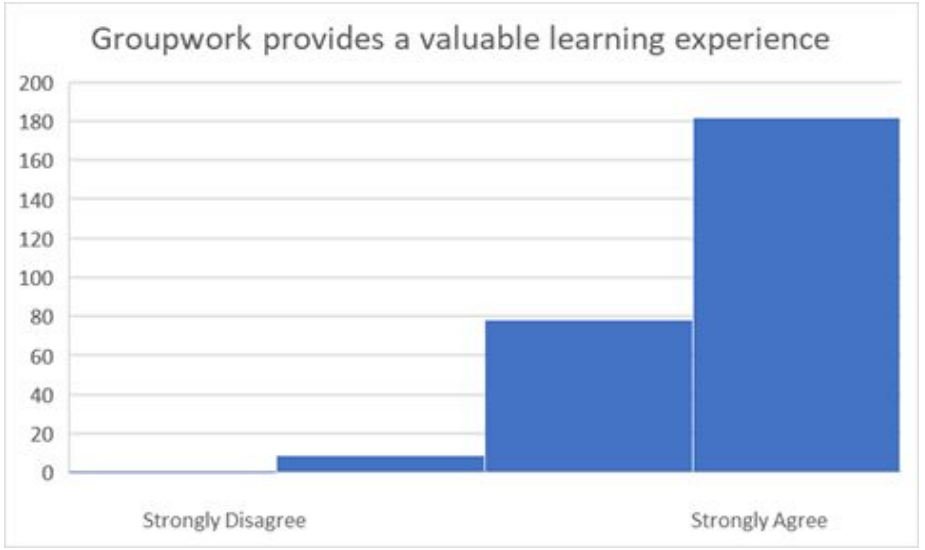


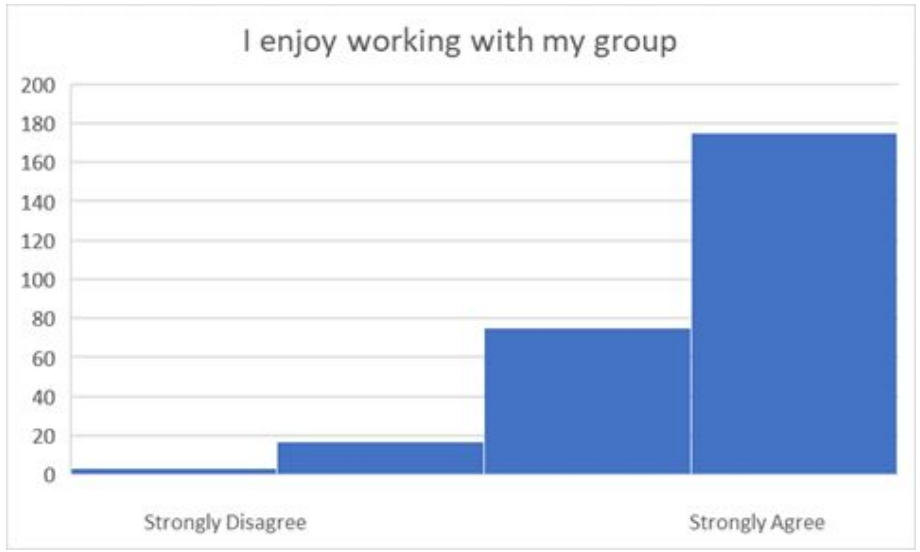
Manager: Keep team on task

Recorder: Enter answers, share screen

Reflector: Make sure everyone is keeping up

Positive reception so far



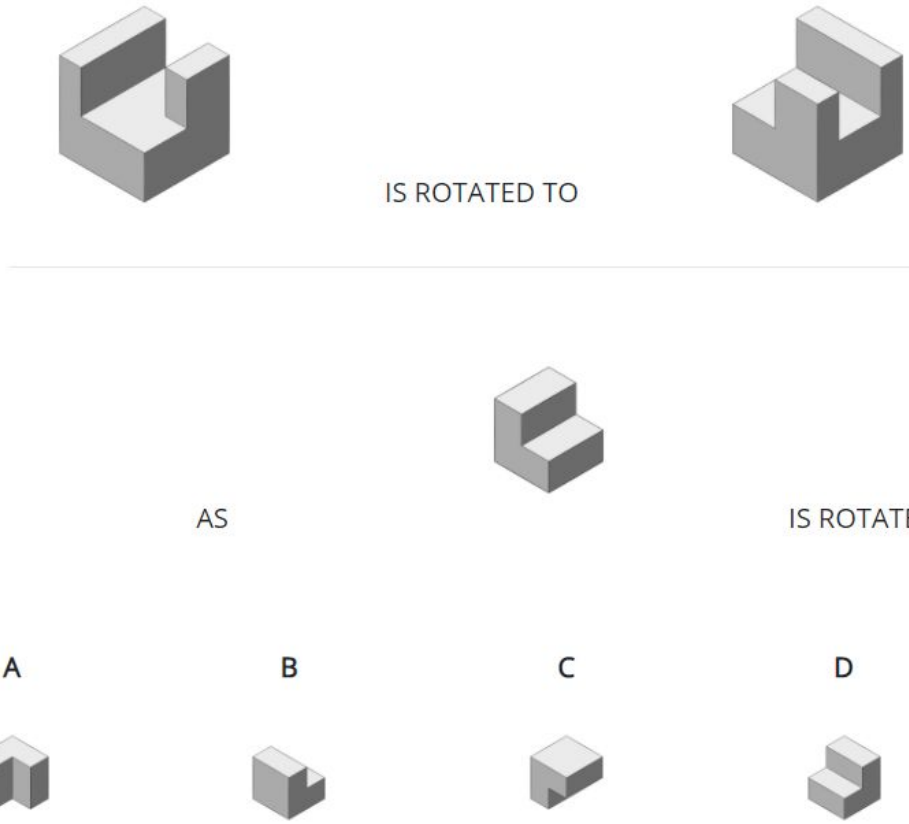


Groups are taking 15-30 minutes less on each assessment than last semester

Brian Woodard
Aerospace Engineering
Virtual Visualization Training

Spatial Visualization Background

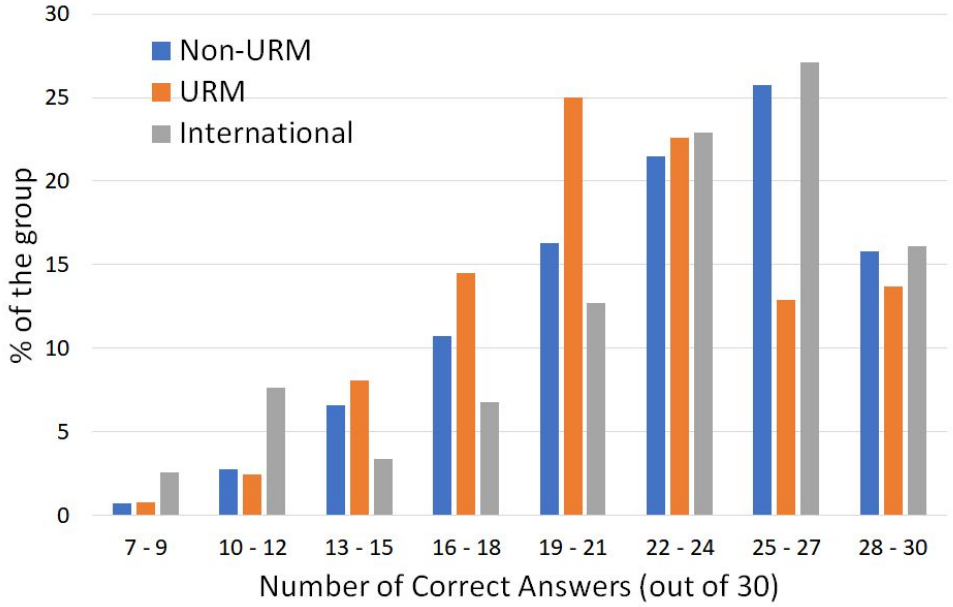
- Spatial skills are one of the strongest predictors of future success in STEM coursework and STEM careers (Shea et al. & Wai et al.)
- Visuospatial skills are malleable, and individuals may need different methods to practice and improve their skills (Sorby et al.)

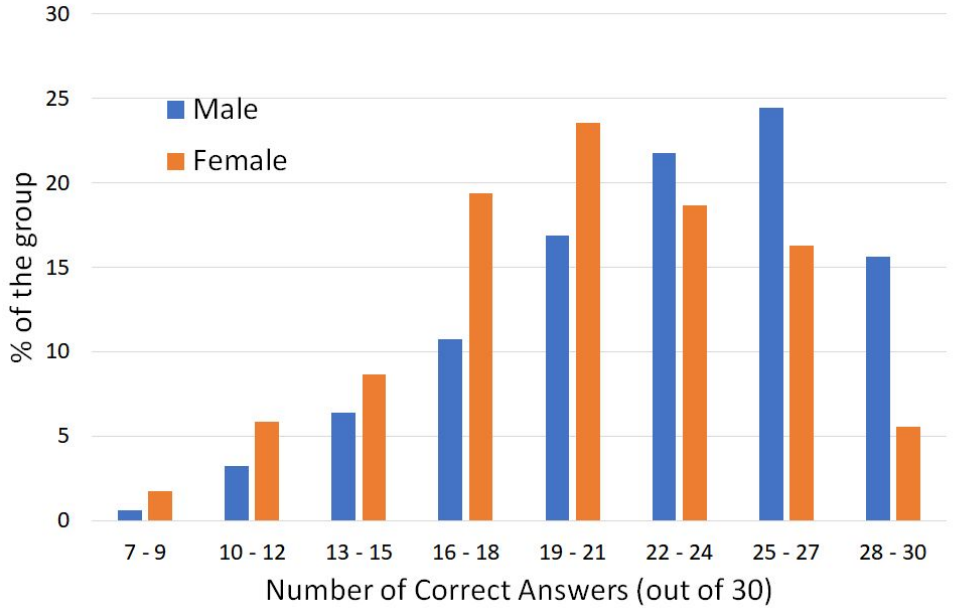


Spatial Skills Among Students

- Visualization skills, especially mental rotation skills, of female students are well documented to lag behind those of their male counterparts (Linn et al. & Voyer et al.)

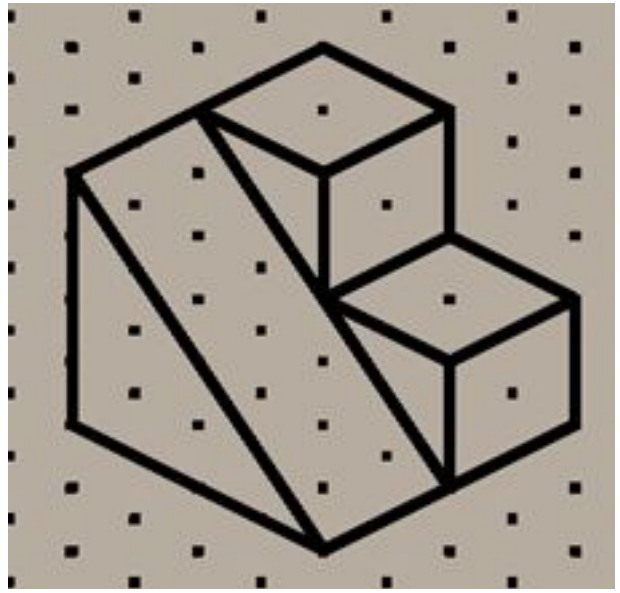
- A standard test of mental rotation skills was given to ~1000 of our Grainger freshmen in spring/summer 2020
- Timed test scored out of a maximum of 30

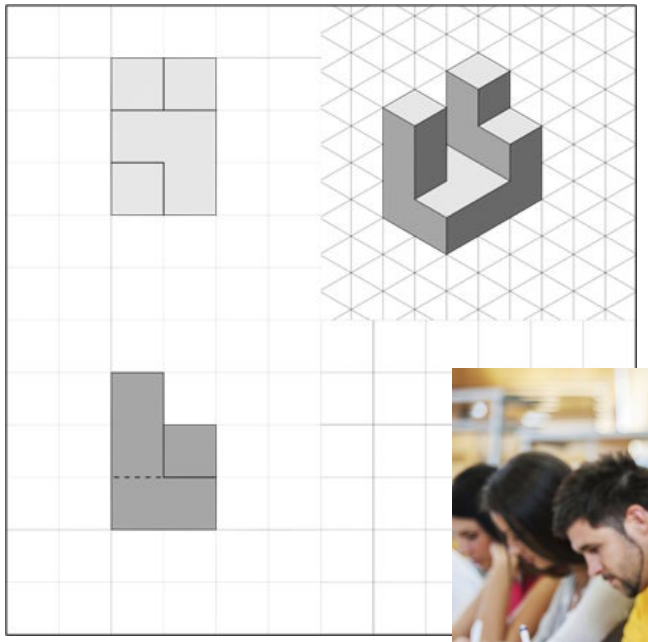




Spatial Skills SIIP Team

- SIIP Team has been working to develop training for spatial skills
- Training traditionally includes:
  - Multiple choice questions
  - Online sketching
  - **Hand sketching**



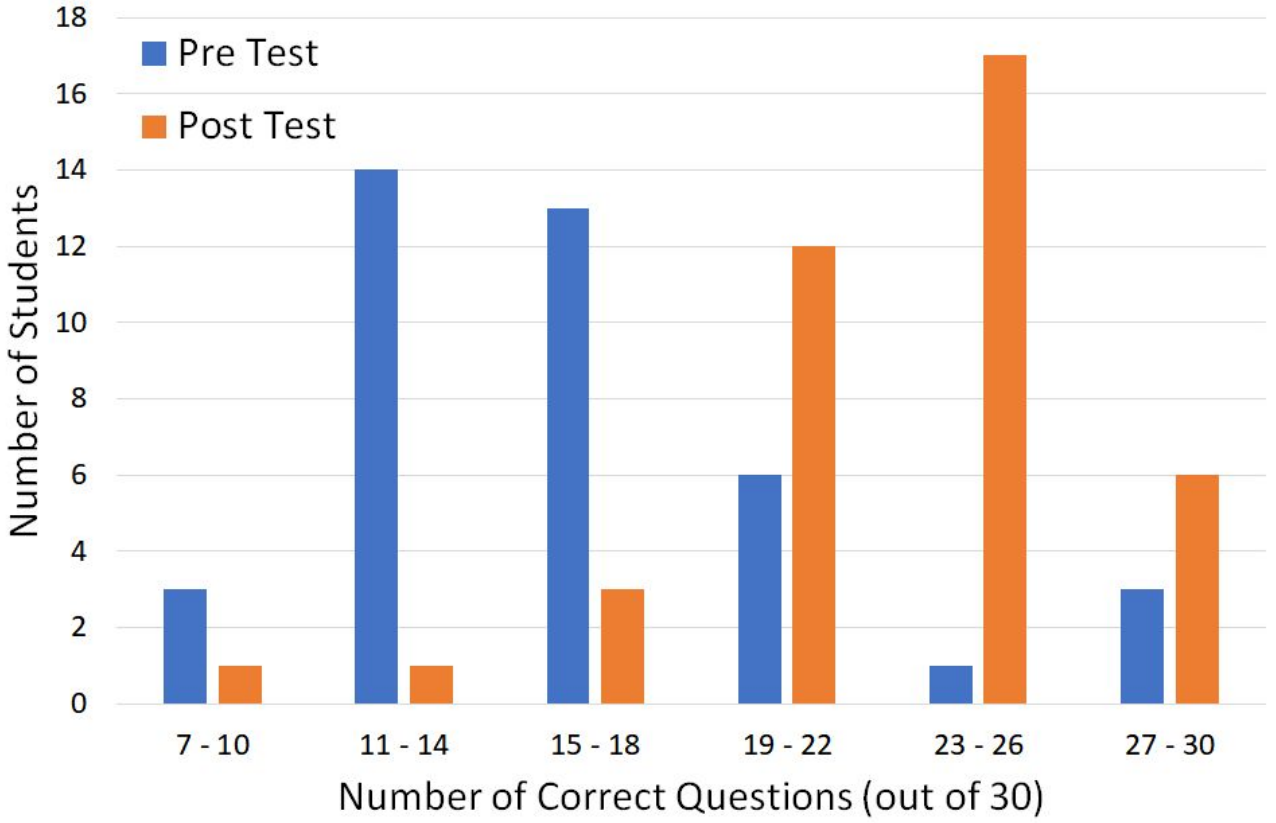


- SIIP Team
  - Molly Goldstein, Mike Philpott
  - Tiffany Li, Ziang Xiao
  - Kirk Leck, Krishna Modi

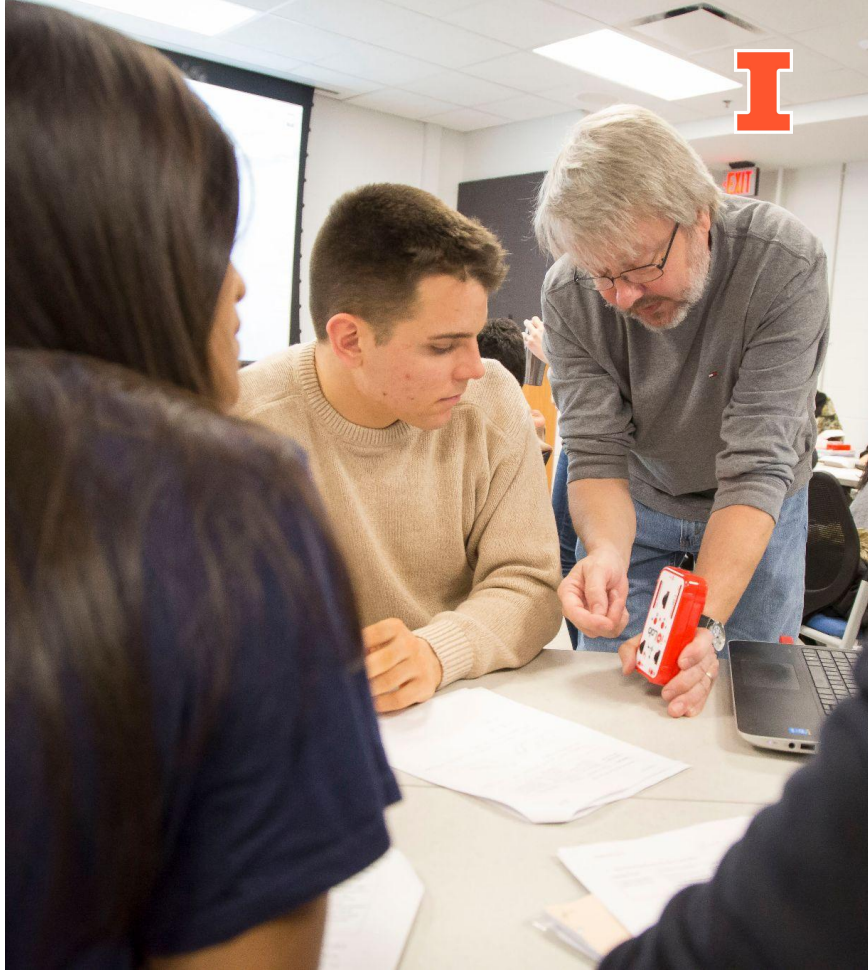
Spatial Skills Training Course

- SIIP team taught an Eng. 177 course in Fall 2020 to teach spatial visualization skills . . . virtually

- Students with lower visualization skills were recommended to take our class
- No hand sketching was utilized
- Alternative, Zoom-based activities were developed for the course
- Students given assessment again at the end of the semester
- **The training can still work!!!**



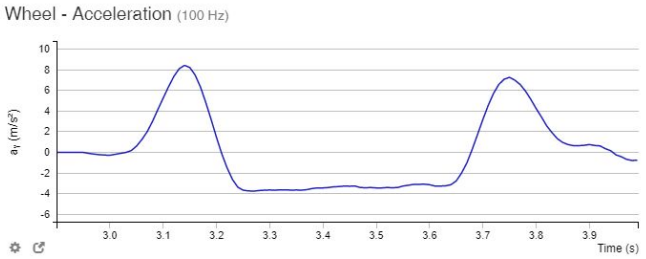
Katie Ansell
Physics
Proximity, proxies, praxis in labs



Our model for collaboration in introductory Physics labs relies on physical proximity

Proxies for proximity in remote instruction: what is needed

ILLINOIS Physics



Remote collaboration challenges:

- Integrating many pieces of technology
- Limited visual channels
- Varied levels of technology familiarity and access
- Increased potential for toxic group situations

For success in remote instruction, we needed to be deliberate about training and group dynamics

Structures added for Fall 2020-Spring 2021

Train everyone before lab starts.

Instructor team: Synchronous

Students: Asynchronous

Name and address group dynamics

Group roles (PI/Skeptic/Analyst)

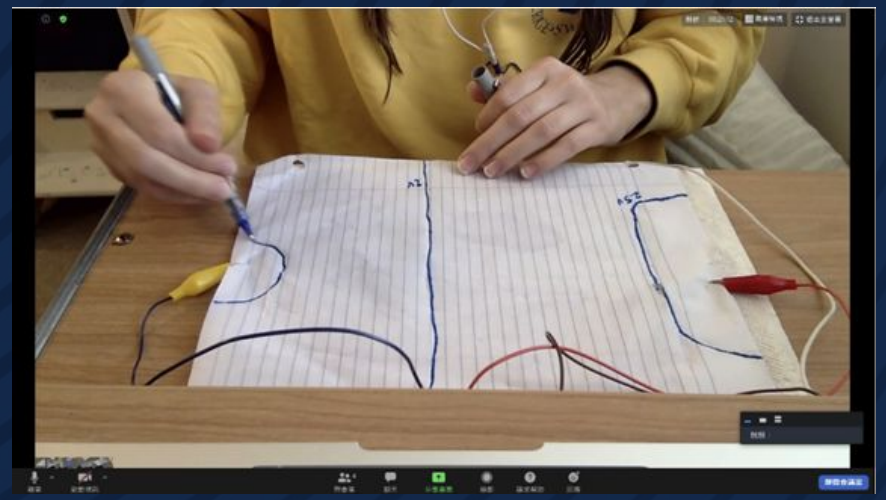
Group contracts Ground rules, remediation

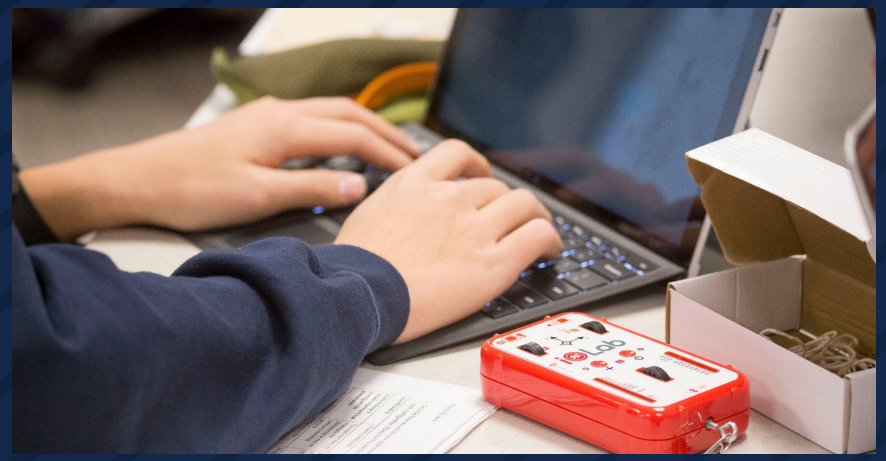
Use first lab meeting to put it together

Lab 0: No experiment

Practice being on Zoom, Teams

Assignment: Write a group contract





These structures establish and communicate our values:

Training:
It takes time to learn how to do new things, and we want our instructors and students to be prepared to succeed in the lab

Group dynamics:
All group members should feel agency, investment, and responsibility for the group as a whole

Because we hold these values for in-person instruction too, we will be keeping these structures in the post-pandemic future

Question & Answer Session

Chris Schmitz, *discussant*
Teaching Associate Professor, ECE
Chief Advisor
Education Innovation Fellow (EIF)

Thank you for attending today's lightning symposium.

If you have any questions, we encourage you to reach out to individual presenters directly, or you can contact:

Jay Mann, Director
AE3
jaymann@illinois.edu
217-333-4861

Thank you for all you do for your students and for Grainger Engineering!

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