

*Building
Data Visualization
Capacity in an
Environment
Transformed
by COVID-19*

*Small Steps & Major Moves in
Higher Education: helping
college students build data
visualization capacity remotely*



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About Me

Vetria L. Byrd, PhD

Academic Preparation

- Computer Science (PhD, MS)
- Biomedical Engineering (MSMBE)



Where I Am Now

- **Academic Appointment**
- Assistant Professor
- Purdue University
- Computer Graphics Technology
- Research Focus: Data Visualization

What I've Done



Visualization Initiatives

- BPViz: Broaden Participation in Visualization (2014/2016)
- Research Experience for Undergraduates in Collaborative Data Visualization Applications (2014/2015)



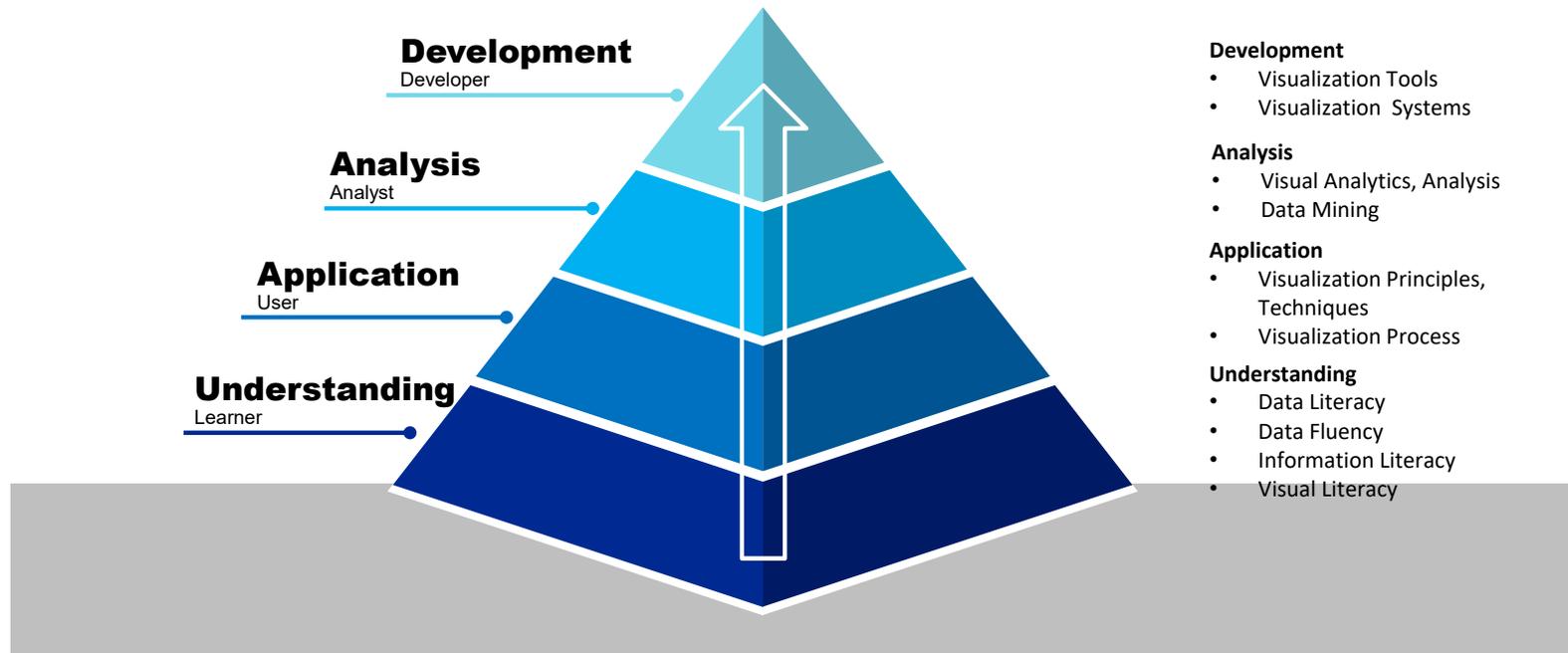
Agent for "Insight"

Overview

- This talk will discuss the redesign of an introductory data visualization college course to meet COVID guidelines for social distancing.
- This semester, in-person engagement has been reshaped to address challenges encountered while providing COVID compliant delivery of content.
- Small steps and major moves made to keep and maintain class participation and engagement while building data visualization capacity of students are discussed.
- Students' perception of the efforts to foster class participation and engagement are also presented.

Where would you like to be?

Building Data Visualization Capacity



Agenda

- About the Course
- Student Demographics
- Logistical Challenges
- Small Steps: We're in this Together
- Major Moves: Multifaceted Strategies for Participation & Engagement
- Students' Perception
- Outcomes

CGT 270 Data Visualization

About the class

CGT 270 Introduction to Data Visualization

- Gateway course for data visualization major
- Two sections:
 - Computer Graphics Technology (CGT) Majors
 - Non-CGT Majors: Data Mine/Data Visualization Learning Community Cohort (LCC)
- Duration: 16 weeks
- Meets twice a week – 1 hr. 50 min. each session
- Lecture/Lab format
- 3 – credit course

Student Demographics

- Undergraduates
 - Computer Graphics Technology (CGT) Majors
 - Data Visualization, Web Programming, UX
 - Non-CGT Majors: Data Mine/Data Visualization (LCC)
 - Engineering, Computer Science, Economics, etc.
- Sophomore or higher
- Little to no background in data visualization

Restructured for COVID Compliance

- In-person instruction limited to 24 students
- Hybrid Format
 - Day 1: Lecture and recorded
 - Day 2: Lab (in person)
- Section > 24 students enrolled
 - Organized into groups

- LLC Section: 15 enrolled

CGT Section (31 enrolled)

Randomly Assigned	Lecture (Online)	Lab (In Person)
Group I (15)	Day 1 (Tuesday)	Day 2 (Thursday)
Group II (16)	Day 2 (Thursday)	Day 1 (Tuesday)

Protect Purdue Plan: COVID Compliance

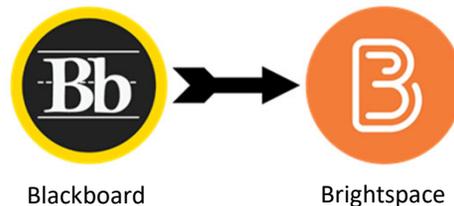
- In-person labs were conducted in accordance with Purdue University's Guidelines for COVID Compliance under the Protect Purdue Plan

TO PROTECT THE HEALTH AND SAFETY OF THE PURDUE COMMUNITY, WE WILL:

- 1 Expect each Boilermaker to assume personal responsibility to Protect Purdue — myself, others, our Purdue community.
- 2 Implement personal health safety practices and protocols.
- 3 Enact health safety changes in physical spaces.
- 4 Offer a range of instructional options for students and faculty.
- 5 Identify and protect the most vulnerable members of the Purdue community.
- 6 Engage our stakeholders with consistent, compelling and timely communication and clear guidance.
- 7 Advance our research mission in a safe and responsible way.
- 8 Anticipate and plan for contingencies.

Logistical Challenges

- Virtual Platform issues
 - Many choices: WebEx, MS Teams, Zoom, Skype, Google Chat
 - Nation-wide tech issues
 - Bandwidth issues
- My Biggest Challenges
 - Changing Learning Management Systems at the start of **The COVID Semester**
 - Participation and Engagement of students in this hybrid form of delivery
 - University Policy: Attendance not a factor in grading this semester



Small Steps: We're in This Together

- Letting students know we are experiencing the pandemic together
 - Each lecture began with an encouraging statement about students' perseverance and tenacity for opting for the in-person experience in spite of the pandemic and for showing up
- Being flexible where the schedule allowed
- Organization and time management

Major Moves

Facilitating participation & engagement to reinforce concepts



Logistics & Guidelines

- Randomly assigned (in most cases, in the beginning)
- Students identify one person to be the scribe for the group
- Each student takes ownership of their contribution (documented by the scribe)
- Rotating scribe position
 - If you served as scribe in a previous group, you must allow someone else to serve in that role
 - This continues until everyone has served as scribe at least once
 - The scribe submits the group document, but everyone in the group is expected to contribute the discussion once the groups come back together

Zoom Experience #1: 1-minute video

- A twist on the Minute Paper Concept
- Provides a quick and extremely simple way to collect feedback on student learning
- Students are randomly assigned to Zoom Breakout rooms
- Students were asked to share and explain a concept from assigned readings, they felt was a key take-away
- Q: What was the most important thing you learned from the assigned reading?
- Q: What do you feel, all students should know and understand after reading the assignment.
- Students were given 10 minutes to create a 1-minute video/audio explaining a key concept of their choosing from assigned reading.
- Students were asked to post their 1 minute videos on the class discussion board during class
 - Watch and post comments before the next class

1-minute video – Student's Responses



- 1-minute concept is a good one
- Enjoyed the opportunity to explain some aspect of the reading
- A good way to reflect
- Really cool thing
- Most students who responded would recommend this activity

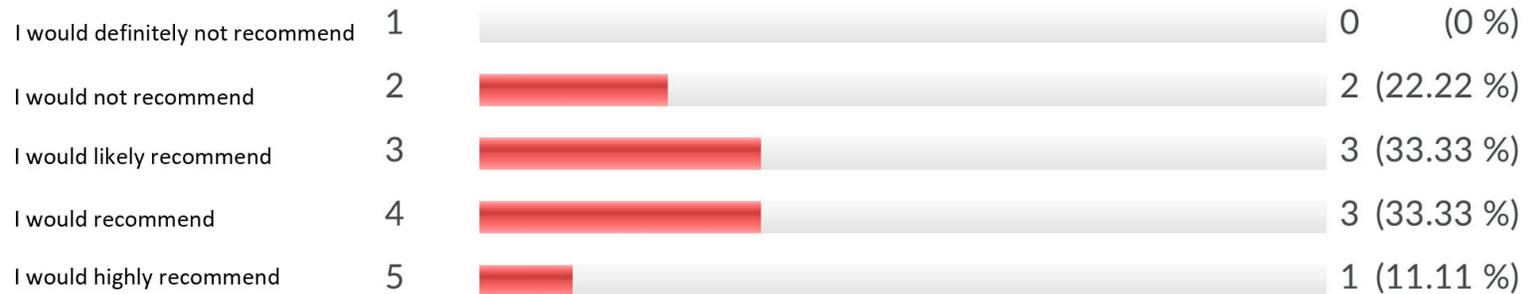


- 10 minutes is too limiting for a 1 minute audio/video (recommend 15 minutes)

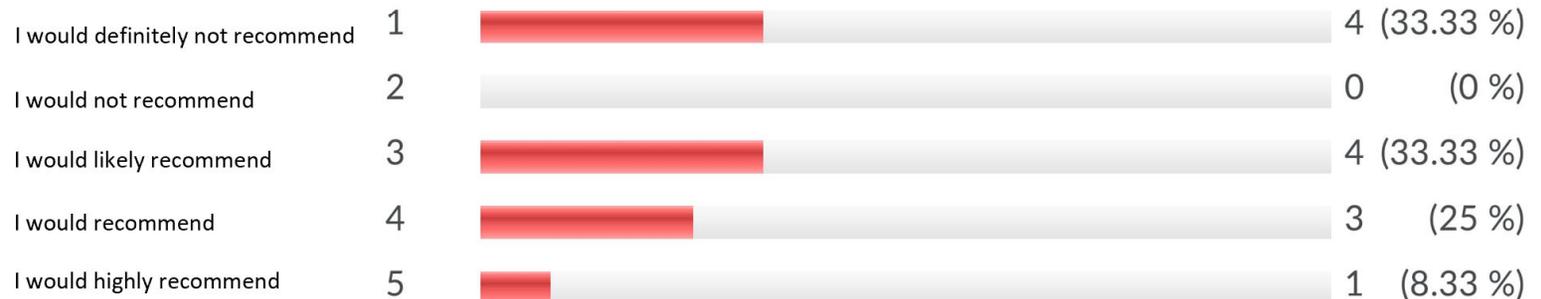
1-minute video – Student Responses



Learning Community



Computer Graphics Technology



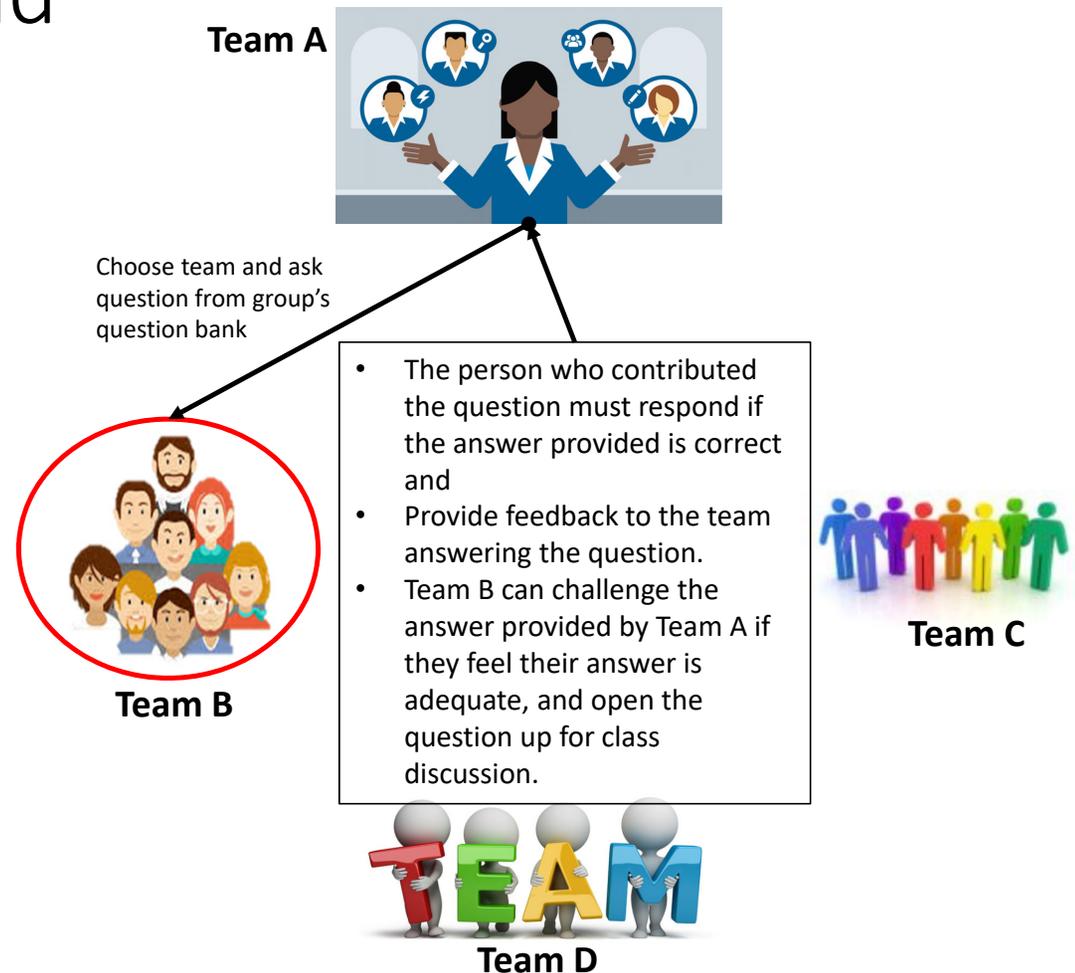
Zoom Experience #2: Q & A Lightning Round

- Students are given weekly reading assignments to be read before class
- Students are randomly assigned to breakout rooms in Zoom
- Each breakout room is assigned a specific section or chapter from the reading
- Each room/group creates a question bank
 - Each member in the breakout room contributes two questions (and the answers) from the assigned reading they felt were key take-aways from the reading(s)



Q & A Lightning Round

- Breakout rooms are closed
- Each team chooses another team to answer a question from the team's question bank.
- The person who contributed the question must determine if the answer provided is correct and
 - Provide feedback to the team answering the question.
- This continues until each team has had an opportunity to ask/answer a question



Q & A Lightning Round

- Each team chooses another team to answer a question from the team's question bank.
- The person who contributed the question must determine if the answer provided is correct and
 - Provide feedback to the team answering the question.
- This continues until each team has had an opportunity to ask/answer a question

Team A



Choose team and ask question from group's question bank



Team B

If answered correctly, Team B gets to choose the next team and ask the next question



Team C



Team D

Q & A Lightning Round

- Each team chooses another team to answer a question from the team's question bank.
- The person who contributed the question must determine if the answer provided is correct and
 - Provide feedback to the team answering the question.
- This continues until each team has had an opportunity to ask/answer a question

Team A



Team B

- If answered incorrectly, the question can be answered by any other team.



Team C



Team D

Q & A Lightning Round

- Each team chooses another team to answer a question from the team's question bank.
- The person who contributed the question must determine if the answer provided is correct and
 - Provide feedback to the team answering the question.
- This continues until each team has had an opportunity to ask/answer a question

Team A



Team B

- The team with the correct answer, gets to choose the next team to answer a question from their question bank



Team C

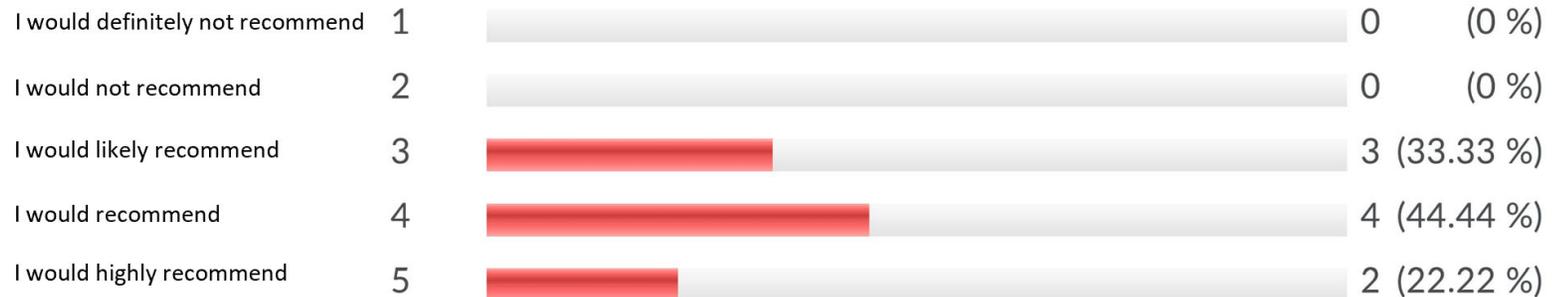


Team D

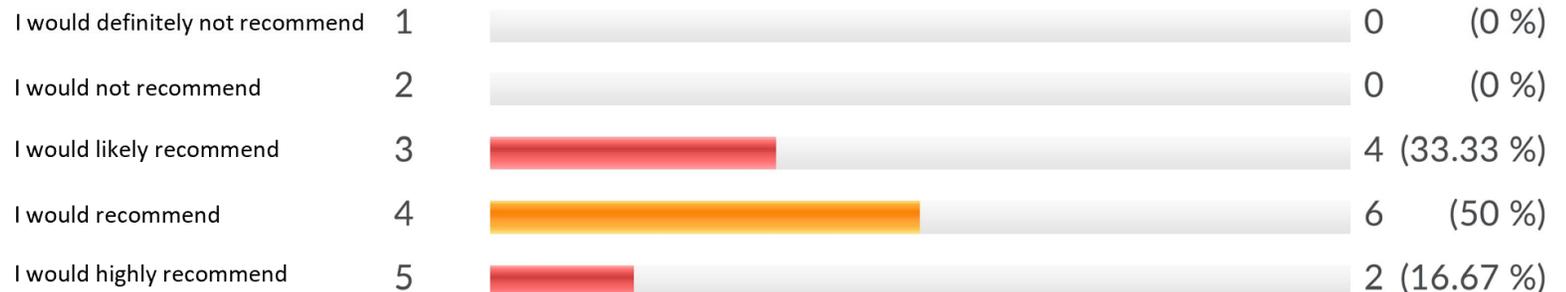
Q & A Lightning Round – Students' Response



Learning Community



Computer Graphics Technology



Zoom Experience #3: Data Vis Bingo (Midterm Prep)

- Play virtual bingo free
- Share the Virtual Link below with up to 30 friends. They can play virtual bingo on any device or print out their bingo card.

- **Virtual Link:**

<https://myfreebingocards.com/>

Bingo Card ID 009

What you should know

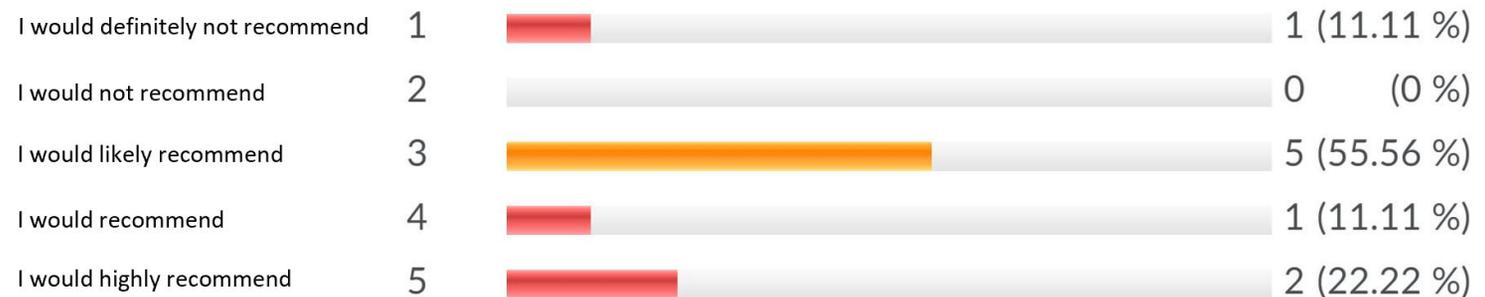
Determine the value of the visualization process	Discuss how output from one stage impacts other stages in the process	Generate a parsed listing of data	Choose the appropriate chart layout
Describe what happens in the Mine stage	Describe what happens in the Parse stage	Explain the impact of Refine on other stages of the data vis process	Explain the interactions between stages
Identify the stages of visualizing data	Describe what stages are impacted by output from the interact stage	Determine the value of filtered data (its usefulness)	Demonstrate the ability to apply each stage of the data visualization process
Plan, generate and produce data	Explain how the acquire stage impacts the visualization process	Apply descriptive statistical methods on data.	Critique the data visualization process

myfreebingocards.com

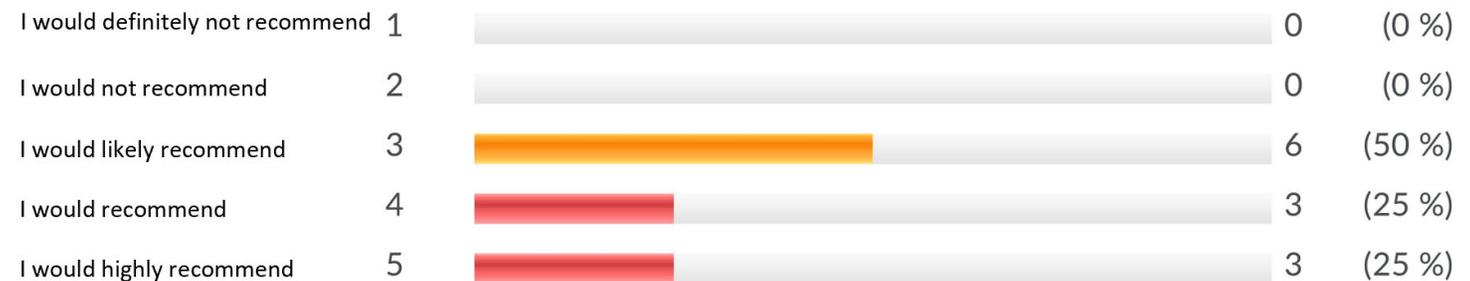
Data Vis Bingo – What you should know



Learning Community



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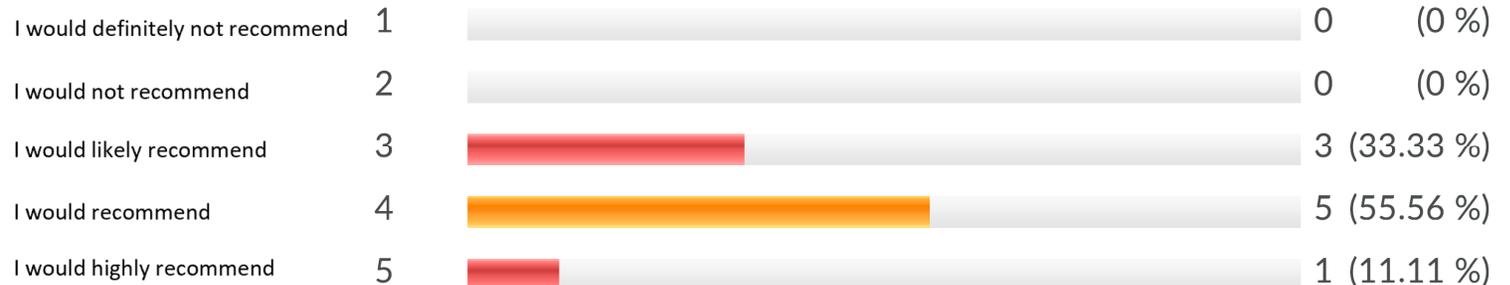
Zoom Experience #4: What's Wrong with this visualization?

- Each breakout room was given a different visualization and were charged with discussing what was wrong with the visualization based on best practices covered in class and in readings
- Each group were tasked with making recommendations for refining the visualization
- Each room share their visualization and recommendations for improvement with the class
- The floor is open for further discussion

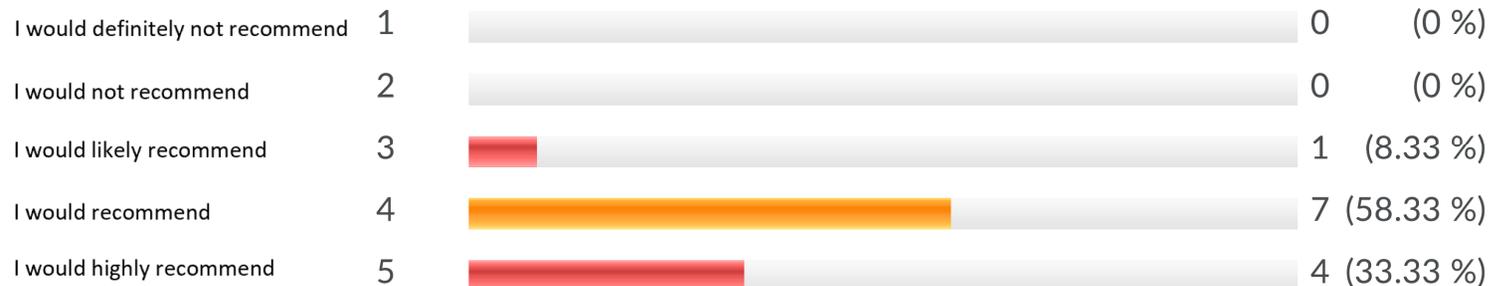
What's Wrong with this visualization: Students' Response



Learning Community



Computer Graphics Technology



Dear Data Project

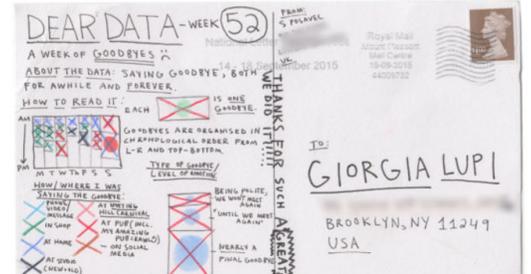
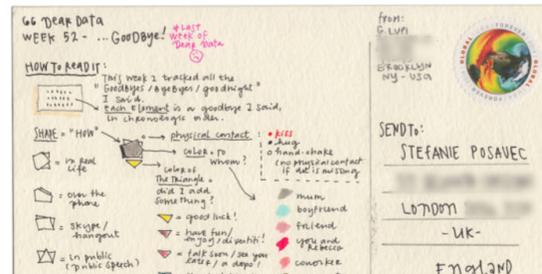
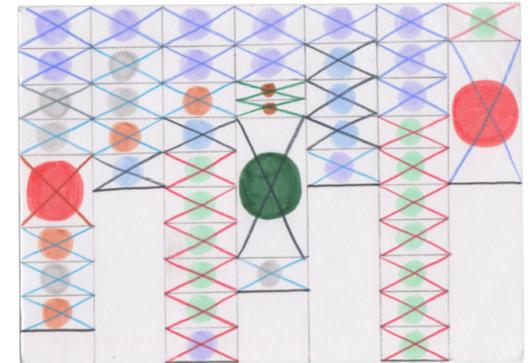
Dear Data

[the book](#) [the project](#) [press](#) [the authors](#) [get in touch](#) [news!](#)

Dear Data is a year-long, analog data drawing project by [Giorgia Lupi](#) and [Stefanie Posavec](#).

We did it! We reached **52 weeks of drawing our data!**

Week 52
A week of goodbyes
Giorgia Stefanie



<http://www.dear-data.com/all>

Dear Data Assignment



Instructional Goals

Students will:

- Develop the ability to draw reasonable inferences from data visualizations,
- Develop the ability to synthesize and integrate information and ideas,
- Develop the ability to think creatively.

Learning Outcomes

Students will:

- Demonstrate how to visually represent data in the absence of visualization tools.
- Demonstrate their ability to interpret data represented in a visual form.
- Demonstrate their ability to simplify without sacrificing quality in representation of data.

<https://web.ics.purdue.edu/~vbyrd/DearData/DearDataAssignment.html>

Data Buddies

- Data Buddies paired from each section/group
- Hand-drawn postcards
- Color is optional
- Delivered (weekly) via email attachment



Dear Data Examples

From CGT 270 Fall 2019

Dear Data Assignment

Week 1 - Introductions

Front



Back

DEAR DATA FROM: Data Buddy 3

Week 1: Introductions

How to Read: What my average week looks like



 - Work in Kitchen as dishwasher

 - work at internship

 - Class

 - Hangout with friends

 - Doing Homework

 - Drinking Coffee

size

 - 1 hr

 - 30 min

- Days Sunday - Saturday

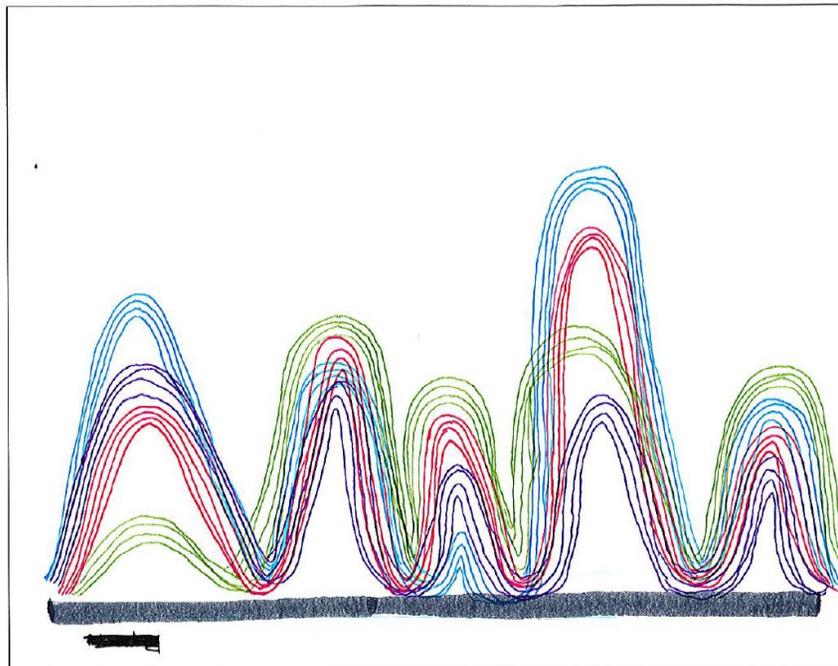
TO:

Data Buddy 4

Dear Data Assignment

Week 2 Theme: What does data look like?

Front



Back

DEAR DATA FROM: [redacted] edu

Week 2: What is Data? What does data look like?

How to Read

What stress data looks like to me

-  = academic stress
-  = personal stress
-  = social stress
-  = No stress
-  = Base
MTWTF



TO: [redacted]

Dear Data: Week 3

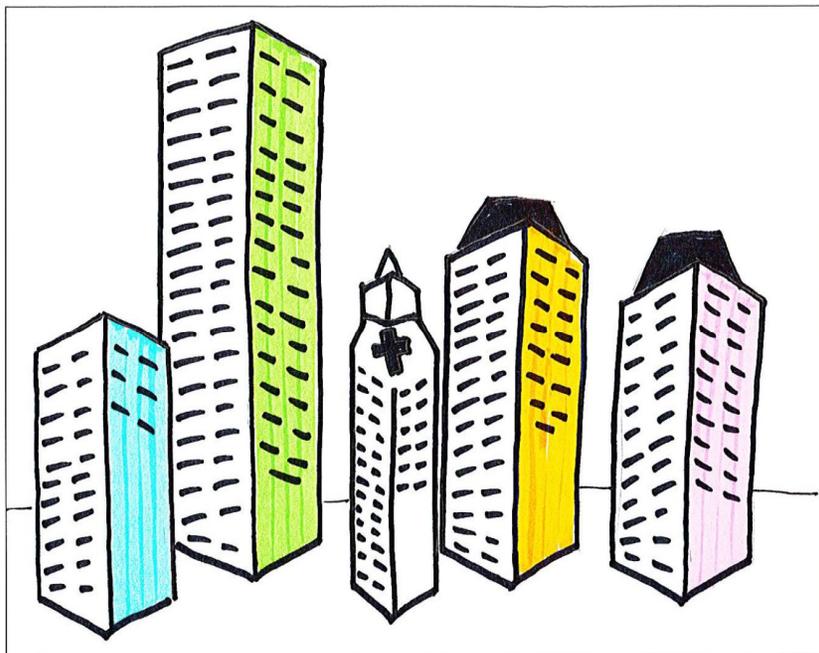
Training Data

Sports • public data • education • government • science • lifestyle
• technology • health • entertainment • business

Dear Data Assignment

Week 3 Theme: What does your training data look like?

Front



Back

DEAR DATA FROM: _____

Week 3: Training Data (Describe your Training Data Set)

How to Read

1 building = 1 industry

 = Computer related

 = Business related

 = Health

 = IT services

 = Software

 = Advertising & Marketing

 = Business products & services

number of windows (lines) = # of companies (in 10s) on the Inc 5000 list for 2014

ex: building above = 50 companies on list

TO: _____

Training And Testing Data

Data Visualization Spotlights

Learning Community Cohort

Fall
2020

Scientist Spotlight

Interviewer



Education

- Southern Connecticut State (MSc)
- Eastern Connecticut State (BSc)

Work Experience

- National Oceanic and Atmospheric Administration (NOAA) Data Visualizer and Manager for Science On a Sphere (SoS)
- Teacher of Environmental Sciences for District of Columbia PS
- Teacher of Biology for New Haven PS

Stephen
Zepecki



Q: What are your day to day responsibilities for NOAA?

A: Designing an education curriculum for science centers and overseeing the management of SoS

Q: What was a memorable project you worked on as a team?

A: Using SoS to display live wildfire data. I oversaw taking the info from a database and translating it to a 3d coordinate space

Takeaway

The most important advice I got from Zepecki during our interview was that learning how to program is extremely important to make yourself stand out in the field of data visualization. You will move up the ladder much faster than anybody who doesn't know.

Likewise, staying up to date with tech trends is equally important. Just because you're done with school doesn't mean there isn't more to learn.

Science on a Sphere

SoS is a room sized display system that uses 6 projectors to display planetary data on a 6ft in diameter sphere. Use cases include displaying atmospheric storms, climate change, and oceanic temperatures in an animated, interactive manner. It is used as a teaching tool in science centers, universities, and museums throughout the country

Fall
2019

Scientist Spotlight

Created by:
Major: Data Visualization and Web Programming & Design
@purdue.edu



Carrie McDougall
Senior Program Manager
at NOAA: National
Oceanic & Atmospheric
Administration



Interview

- How large are the data sets you work with, and how do you mitigate performance issues arising from the size?
 - We work with data from the bottom of the ocean to the sun. We do not visualize or display them at their highest resolution
- Do projects generally look more at the broad picture or individual elements?
 - Broad picture but we also realize that we need to show smaller parts.
- **Takeaway:** Technical skills are important but, communication skills are just as important. Dr. McDougall said in the interview that she is constantly collaborating on projects and that communication is key.

Work Experience

- NOAA: National Oceanic & Atmospheric Administration
 - February 2004- Present
 - Senior Program Manager
- Feb 2003 – Jan 2004
 - NOAA Sea Grant John A. Knauss Marine Policy Fellow



Education

- UC Santa Barbara
 - PhD: Ecology, Evolution, and Marine Biology
- UCLA
 - B.S: Biology with a specialization in marine biology



Engagement in CGT 270 vs. Other Classes this Semester

- This lecture differs from other online lectures because this lecture is more focused on individual and group work that everyone else is doing, while my other lecture is largely group based and we are often left to our own devices in our individual groups.
- Most of my other online lectures just have videos. We don't have real-time meetings.
- My other classes just have us listen and ask questions if we need to rather than involving us in activities.
- In my other classes I haven't been able to talk with others in the class, but with this class I have been able to communicate with my classmates.

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@VByrdPhD, @BPViz, @ByrdVisLab

Purdue Polytechnic Institute



Thank You Image Source:

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