NAU NORTHERN ARIZONA UNIVERSITY

Center for Science Teaching and Learning

SEMINAR SERIES IN STEM EDUCATION

The COVID-19 Pandemic and Systemic Racism: Creating "A New Normal" for STEM Education with Social Justice for All Students

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Todd Campbell

- ***Research*** focuses on cultivating imaginative and equitable representations of STEM
- ***Policy*** contributions include scholarly publications focused on the implementation of national and state standards
- ***Practice*** commitment is embodied in the publication of several practice briefs and practitioner-oriented articles

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Okhee Lee

- ***Research*** focuses on equity in science and STEM education for all students, especially English learners
- ***Policy*** contributions include serving on the NGSS writing team and leading the NGSS Diversity and Equity Team
- ***Practice*** commitment was recognized by the 2020 NSTA Distinguished Service to Science Education award

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Purpose

- The purpose is to propose an instructional framework for STEM education that is centered around social justice for all students

- The instructional framework leverages data science, computer science, and convergence of STEM disciplines, which are key to finding solutions to COVID-19 while being complicit with systemic racism

- The instructional framework involves STEM disciplines and STEM education working in concert to address systemic racism

Proposed Instructional Framework

Area 1. Using data science and computer science, students make sense of complex real-world phenomena and problems

Area 2. Through the convergence of multiple STEM subjects, students make informed decisions and take responsible actions

Area 3. STEM education should promote social justice for all students

Lee, O., & Campbell, D. T. (2020). What science and STEM teachers can learn from COVID-19: Harnessing data science and computer science through the convergence of multiple STEM subjects. *Journal of Science Teacher Education, 31*(8), 932-944.

Area 1: Data Science and Computer Science

Area 1: Data science and computer science promote K-12 students to make sense of phenomena and complex societal problems

1) Students find phenomena compelling to figure out

Johns Hopkins University
Coronavirus Resource Center
https://coronavirus.jhu.edu/map.html

Area 1: Data Science and Computer Science

Johns Hopkins Coronavirus Resource Center
Johns Hopkins University & Medicine
https://coronavirus.jhu.edu
https://coronavirus.jhu.edu/map.html

Area 1: Data Science and Computer Science

Johns Hopkins University Coronavirus Resource Center
https://coronavirus.jhu.edu/map.html

In breakout rooms, consider some of the following questions (5 min):

As of 3:30 pm EST on January 21, 2021:

1) Worldwide, the data show X confirmed cases and X deaths
   In the US, the data show X confirmed cases and X deaths
   In NY, the data show X confirmed cases and X deaths

2) The X confirmed cases in the US constitute X% worldwide
   The X deaths in the United States constitute X% worldwide

3) Explore your own district
   a) Go to “US Map”
   b) Type “States/Territories”
   c) Type “County (or Equivalent)”

Area 1: Data Science and Computer Science

A Sample of Data Sources

University Research Centers

Johns Hopkins University: Coronavirus Resource Center
https://coronavirus.jhu.edu/map.html

Our World in Data: Statistics and Research Coronavirus Pandemic (COVID-19)
https://ourworldindata.org/coronavirus

News Media

Bloomberg: Mapping the Coronavirus Outbreak Across the World
https://www.bloomberg.com/graphics/2020-coronavirus-cases-world-map/?utm_source=twitter&utm_medium=cpc&utm_campaign=covid_tracker&utm_content=tofu

Financial Times: Coronavirus Tracked: The Latest Figures as Countries Start to Reopen
https://www.ft.com/content/a26fbf7e-48f8-11ea-aeb3-955839e06441?campaign=march20&segmentID=91adc6f0-8387-0702-925f-7e46769f36ab

The New York Times: Coronavirus Map: Tracking the Global Outbreak
https://www.nytimes.com/interactive/2020/world/coronavirus-maps.html?campaign_id=9&emc=edit_NN_p_20200424&instance_id=17910&nl=morning-briefing&regi_id=128196943&section=topNews&segment_id=25875&te=1&user_id=8a1534b4d44c04ec54f11d47daf73a58

The Washington Post: Guide to the Pandemic

Area 1: Data Science and Computer Science

Area 1: Data science and computer science promote K-12 students to make sense of phenomena and complex societal problems

2) Students explain phenomena and design solutions to problems

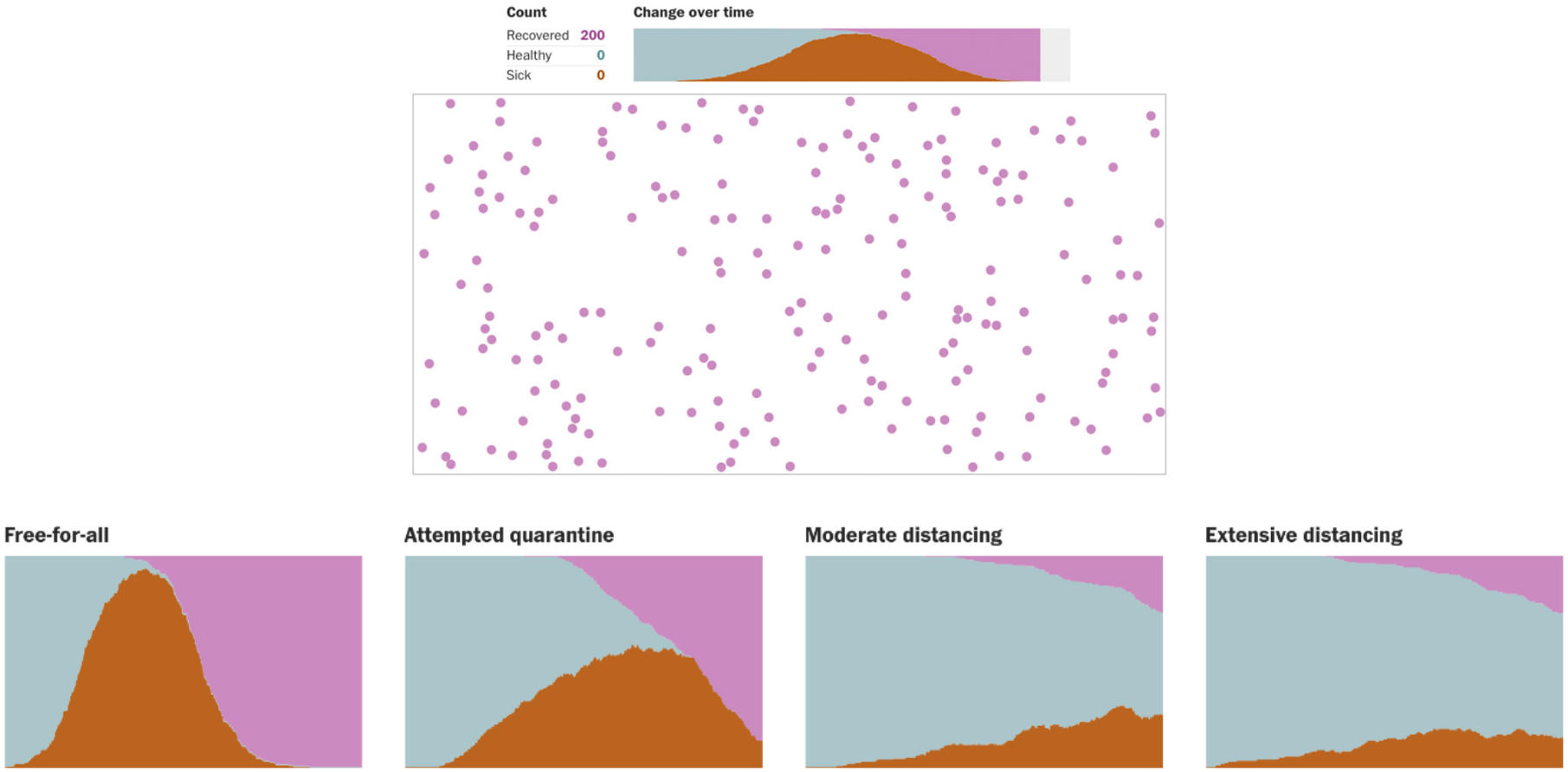
The Washington Post

"Why Outbreaks Like Coronavirus Spread Exponentially, and How to 'Flatten the Curve'"

https://www.washingtonpost.com/graphics/2020/world/corona-simulator/

Area 1: Data Science and Computer Science

Example of Publicly Available Computer Simulations Using COVID-19 Data



The Washington Post
"Why Outbreaks Like Coronavirus Spread Exponentially, and How to 'Flatten the Curve'"
https://www.washingtonpost.com/graphics/2020/world/corona-simulator/

Area 1: Data Science and Computer Science

Area 1: Data science and computer science promote K-12 students to make sense of phenomena and complex societal problems

In breakout rooms, try out the following computer simulation model (5 min)

The Washington Post

"Why Outbreaks Like Coronavirus Spread Exponentially, and How to 'Flatten the Curve'"

https://www.washingtonpost.com/graphics/2020/world/corona-simulator/

Area 1: Data Science and Computer Science

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The Washington Post

"Why Outbreaks Like Coronavirus Spread Exponentially, and How to 'Flatten the Curve'"
https://www.washingtonpost.com/graphics/2020/world/corona-simulator/

"Disease Modelers Are Wary of Reopening the Country. Here's How They Arrive at Their Verdict. To See How Their Models Work, We'll Let You Tweak Your Own"
https://www.washingtonpost.com/graphics/2020/health/disease-modeling-coronavirus-cases-reopening/?utm_campaign=wp_post_most&utm_medium=email&utm_source=newsletter&wpisrc=nl_most

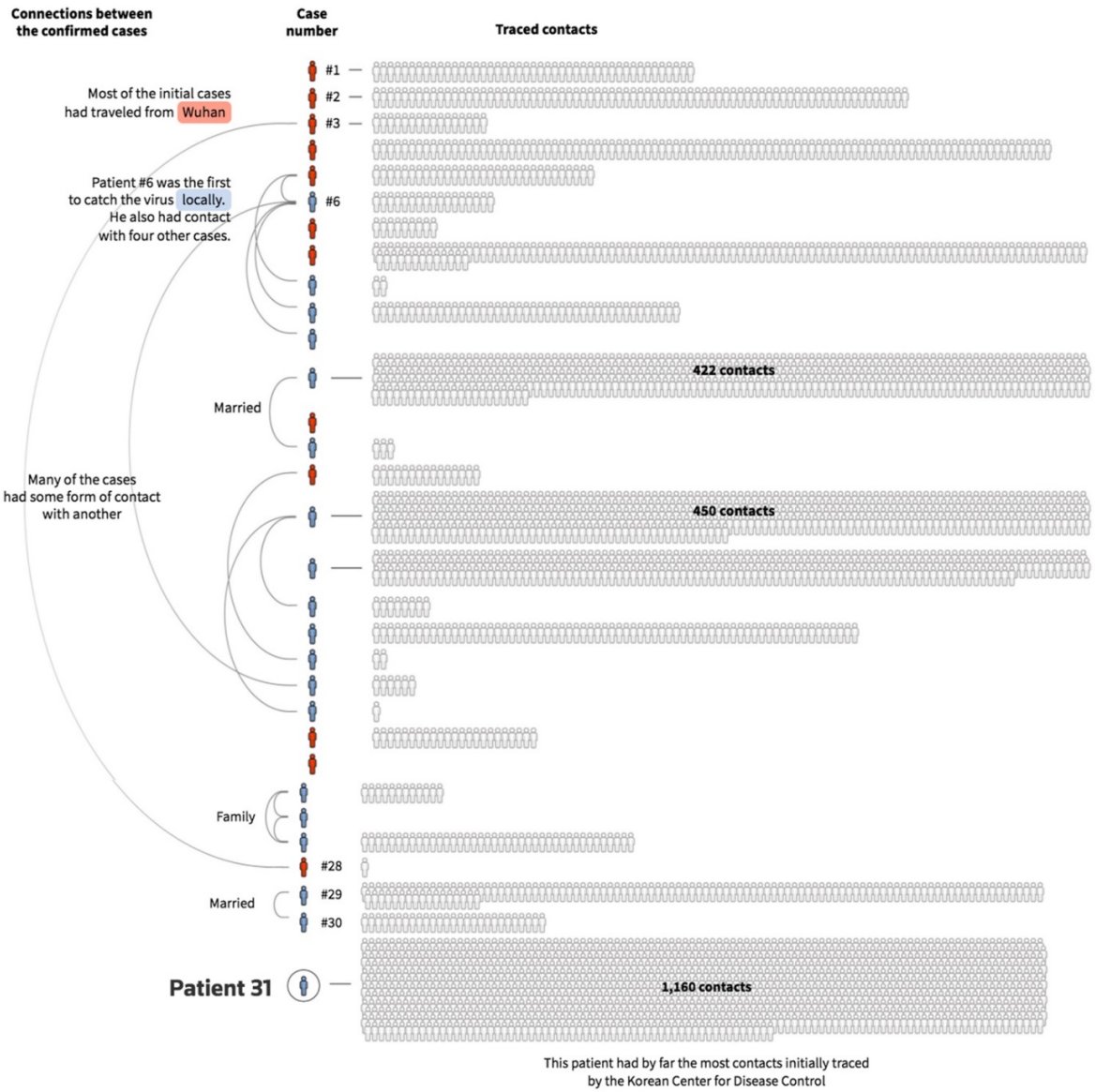
Area 2: Convergence of Multiple STEM Subjects

Area 2: Convergence of multiple STEM subjects facilitate K-12 students making informed decisions and taking responsible actions

1) Solutions to the COVID-19 pandemic involve **each individual** doing their part

Reuters
"The Korean Clusters," by M. Hernandez, S. Scarr, and M. Sharma, 2020
https://graphics.reuters.com/CHINA-HEALTH-SOUTHKOREA-CLUSTERS/0100B5G33SB/index.html
1) Social distancing
2) Contact tracing

Area 2: Convergence of Multiple STEM Subjects



How COVID-19 spread through Daegu, South Korea

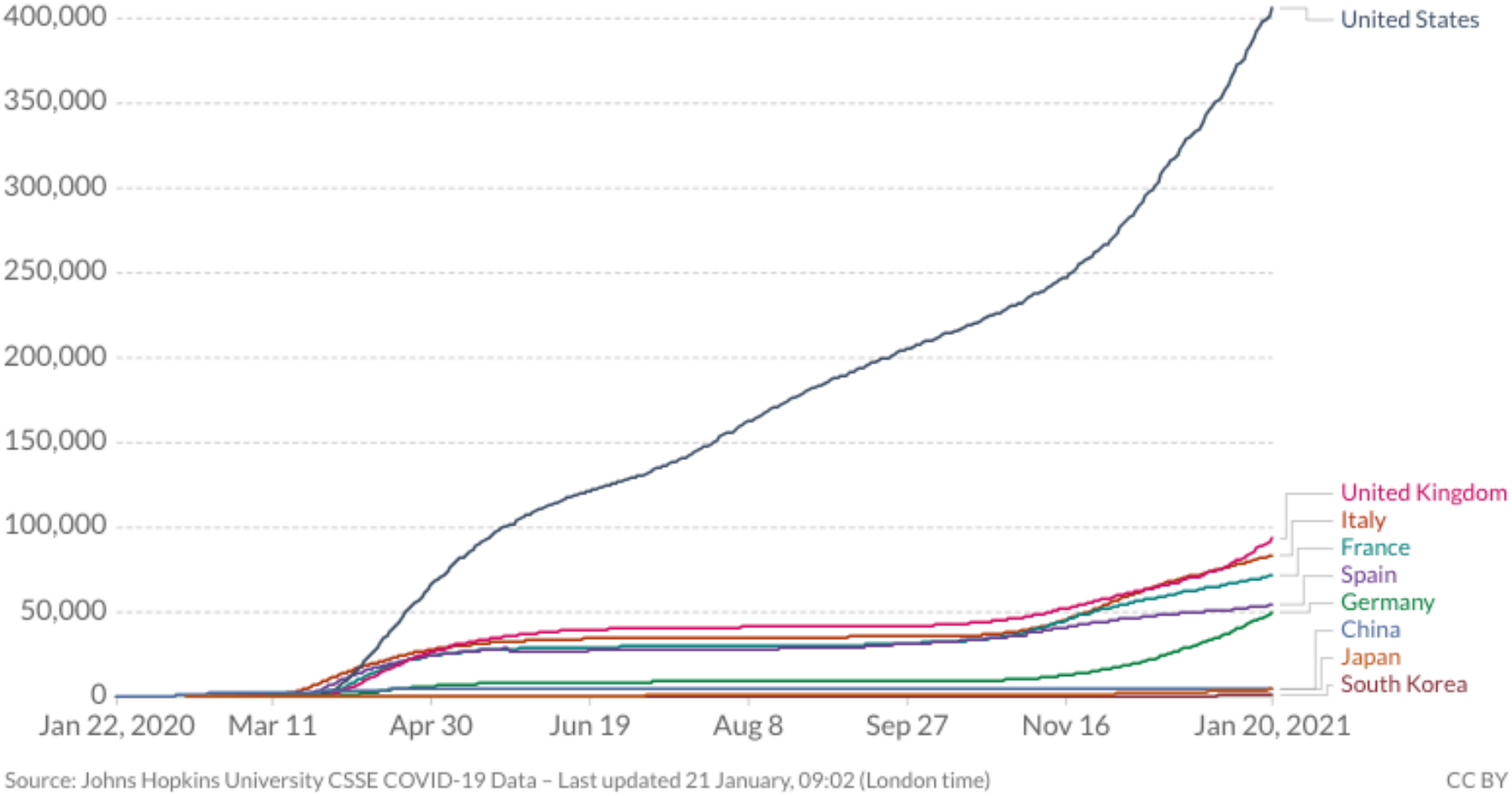
Reuters
"The Korean Clusters," by M. Hernandez, S. Scarr, & M. Sharma, 2020
https://graphics.reuters.com/CHINA-HEALTH-SOUTHKOREA-CLUSTERS/0100B5G33SB/index.html

Area 2: Convergence of Multiple STEM Subjects

Area 2: Convergence of multiple STEM subjects facilitate K-12 students making informed decisions and taking responsible actions

2) Solutions to the COVID-19 pandemic involve **each society** doing its part

Area 2: Convergence of Multiple STEM Subjects



Our World in Data

"Coronavirus Pandemic (COVID-19)," by M. Roser, H. Ritchie, E. Ortiz-Ospina, and J. Hasell, 2021
https://ourworldindata.org/coronavirus

Area 2: Convergence of Multiple STEM Subjects

Area 2: Convergence of multiple STEM subjects facilitate K-12 students making informed decisions and taking responsible actions

In breakout rooms, explore the data (5 min)

Our World in Data

https://ourworldindata.org/coronavirus

Area 2: Convergence of Multiple STEM Subjects

Area 2: Convergence of multiple STEM subjects facilitate K-12 students making informed decisions and taking responsible actions

The New York Times

Coronavirus Map: Tracking the Global Outbreak
https://www.nytimes.com/interactive/2020/world/coronavirus-maps.html?campaign_id=9&emc=edit_NN_p_20200424&instance_id=17910&nl=morning-briefing&regi_id=128196943&section=topNews&segment_id=25875&te=1&user_id=8a1534b4d44c04ec54f11d47daf73a58

United States

States, Territories and Cities

Area 3: Social Justice for All

Area 3: STEM disciplines and STEM education in concert address systemic racism

1) Students attend to systemic racism in the COVID-19 pandemic

Area 3: Social Justice for All

Area 3: STEM disciplines and STEM education in concert address systemic racism

- **Racial inequity of COVID-19**
  https://www.nytimes.com/interactive/2020/07/05/us/coronavirus-latinos-african-americans-cdc-data.html?action=click&campaign_id=9&emc=edit_nn_20200706&instance_id=20044&module=Top+Stories&nl=the-morning&pgtype=Homepage&regi_id=128196943&segment_id=32688&te

- **Latinos with an especially high infection rate of COVID-19, a sign of a makeup of essential work force**
  https://www.nytimes.com/2020/06/26/us/corona-virus-latinos.html?campaign_id=9&emc=edit_nn_20200626&instance_id=19769&nl=the-morning&regi_id=128196943&segment_id=31917&te=1&user_id=8a1534b4d44c04ec54f11d47daf73a58

Area 3: Social Justice for All

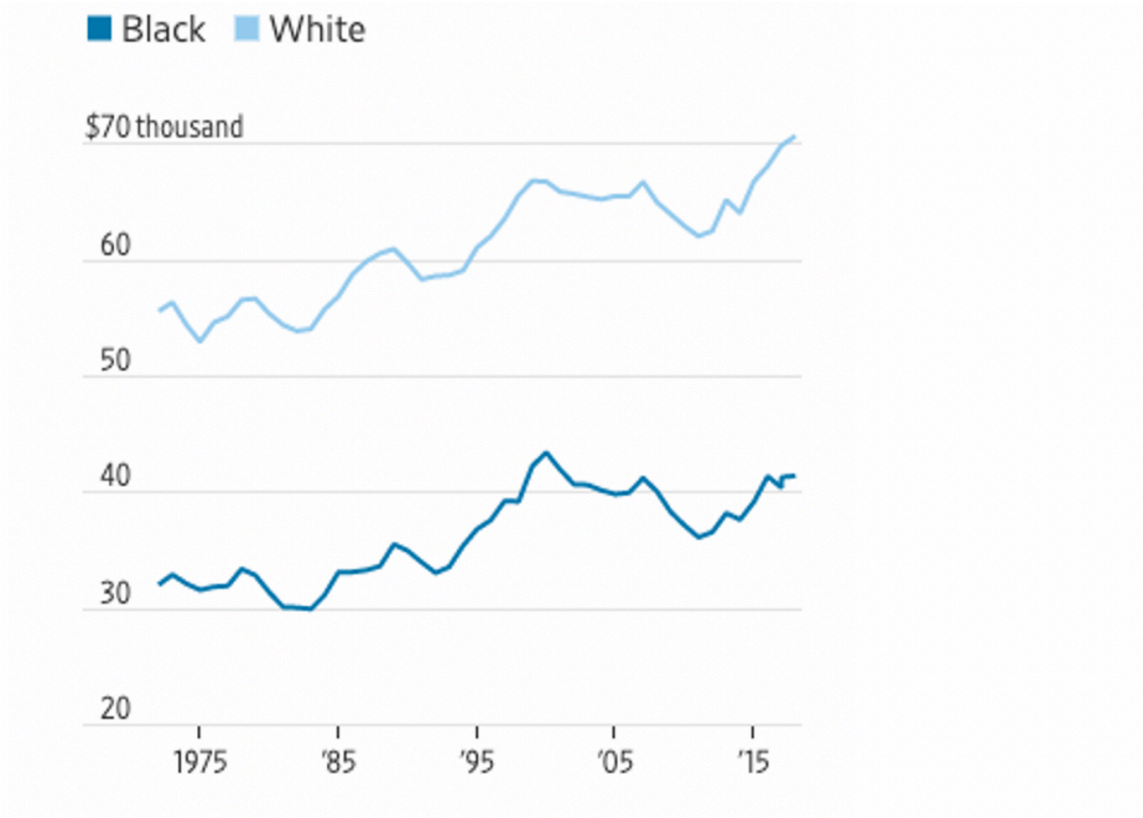
Area 3: STEM disciplines and STEM education in concert address systemic racism

2) Students understand that solutions to the COVID-19 pandemic involve addressing systemic racism

- **Black-White income gap**
  https://www.wsj.com/articles/for-african-americans-a-painful-economic-reversal-of-fortune-11591176602?st=6peib0558gnq91l
- **Black-White wage gap**
  https://www.nytimes.com/2020/06/25/briefing/coronavirus-ahmaud-arbery-hamilton-your-thursday-briefing.html
- **High incarceration rates of black men**
  https://www.nytimes.com/2020/06/03/briefing/protests-steve-king-coronavirus-your-wednesday-briefing.html

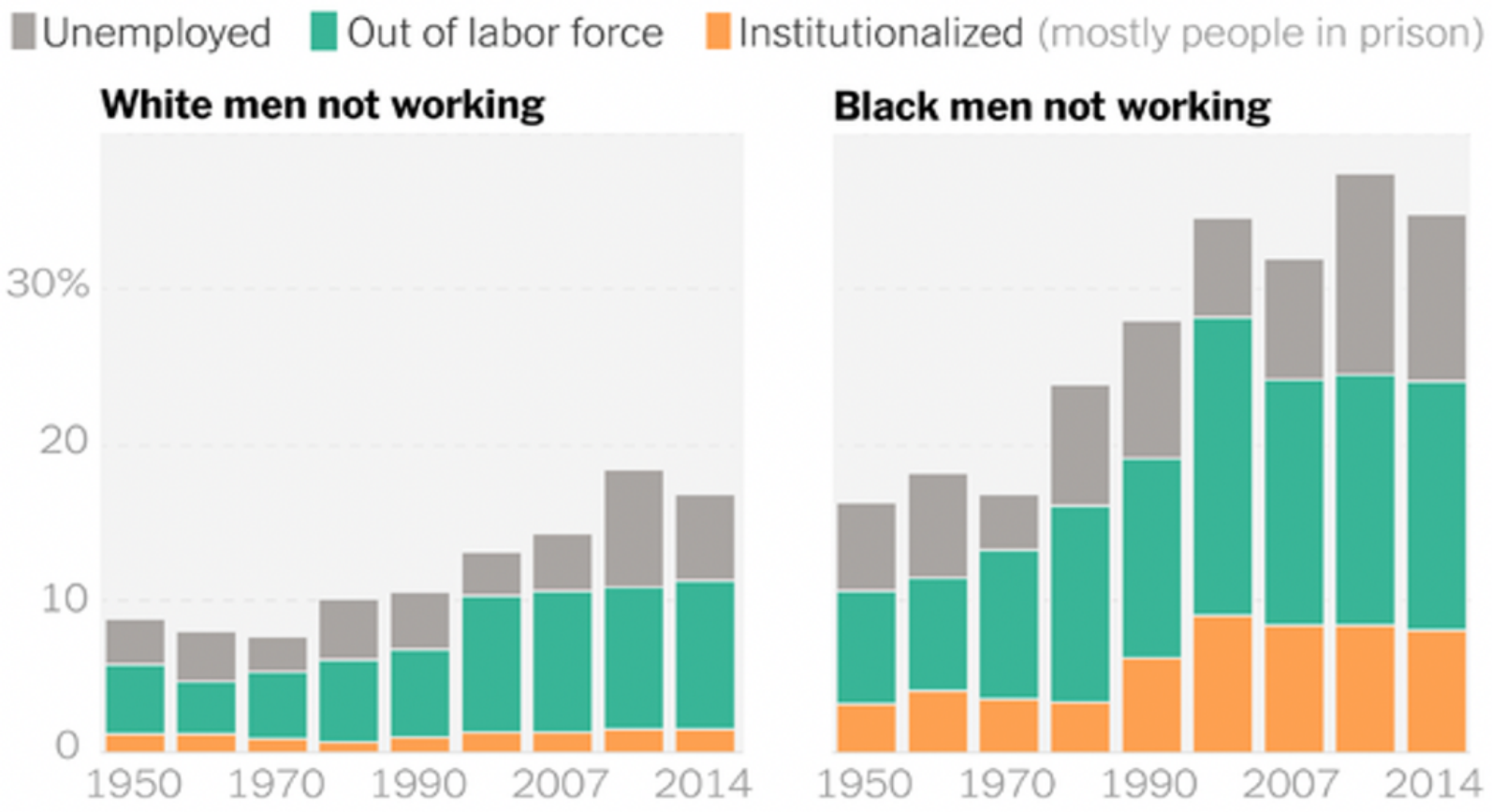
Area 3: Social Justice for All

Income Gap Between Black and White Households



The Wall Street Journal
"For African-Americans, a Painful Economic Reversal of Fortune," by G. Ip, 2020
https://www.wsj.com/articles/for-african-americans-a-painful-economic-reversal-of-fortune-11591176602?st=6peib0558gnq91l

Area 3: Social Justice for All



The New York Times
"The Enormous Black-White Wage Gap," by D. Leonhardt, 2020
https://www.nytimes.com/2020/06/25/briefing/coronavirus-ahmaud-arbery-hamilton-your-thursday-briefing.html

Area 3: Social Justice for All

- COVID-19 provides an example of how students can attend to the consequences of systemic racism while participating in STEM education
- Such systemic racism manifests in disproportionately higher rates of COVID-19 cases and deaths among racial minorities, low-income communities, inmates, and other marginalized groups
- As students recognize systemic racism associated with COVID-19, they are positioned to question underlying reasons for its existence and propose potential justice-centered solutions to begin to address systemic racism in the society at large

NSTA Daily Do Lesson #1

- The following is an example of what our framework might look like in the context of a middle school science lesson:

How can we make informed decisions to keep ourselves and our communities safe during the COVID-19 pandemic?

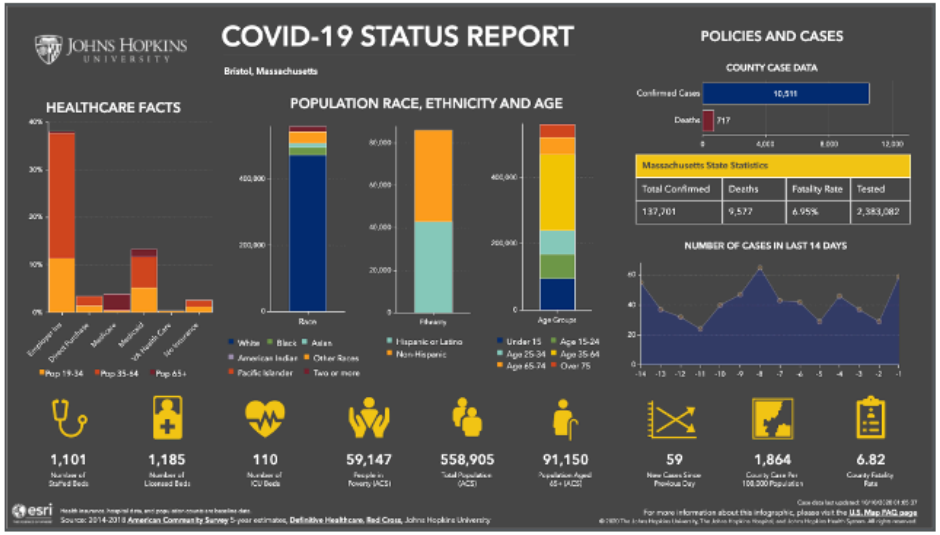
- Students and their families explain differences found when comparing COVID-19 data for their local county to COVID-19 data for another county (or equivalent) and propose informed solutions for keeping themselves and their communities safe.

NSTA Daily Do Lesson #1

In the Lesson – Part 1

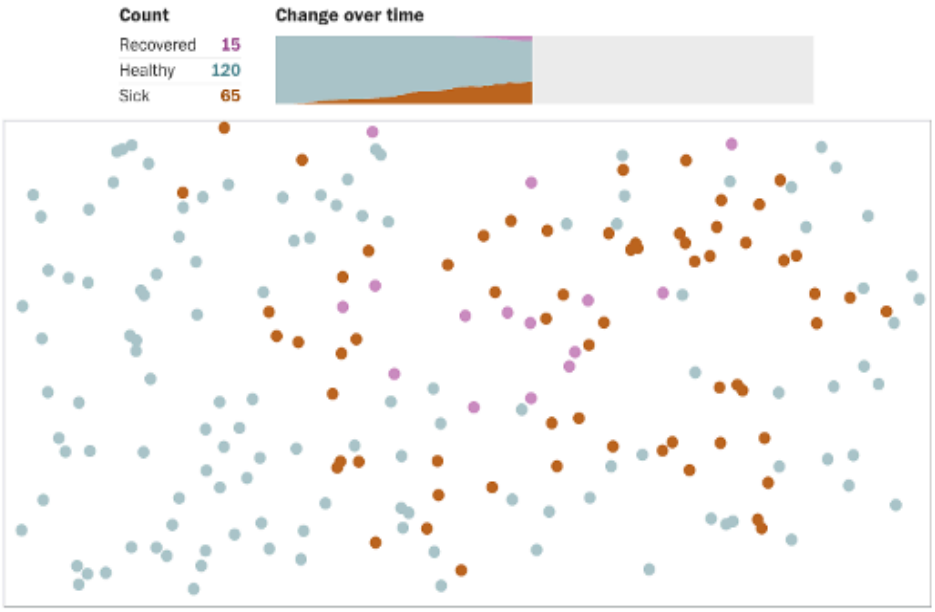
Students examine local and regional patterns of COVID19 spread and make observations using the Johns Hopkins Coronavirus Resource Center's COVID-19 Dashboard

[Data Science]



Note. From *COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)*, 2020 (https://coronavirus.jhu.edu/map.html). Copyright 2020 by Johns Hopkins University & Medicine.

NSTA Daily Do Lesson #1



In the Lesson – Part 2

Students explore simulations to better understand the mechanism of viral spread and strategies for flattening the curve of viral spread amongst a population

[Simulations/Computer Science]

NSTA Daily Do Lesson #1

In the Lesson – Part 3

Students examine CDC guidance and propose recommendation for their schools

[Making informed decisions and taking responsible action]

Indicators and Thresholds for Risk of COVID-19 Transmission in Schools

INDICATORS	Lowest risk of transmission in schools	Lower risk of transmission in schools	Moderate risk of transmission in schools	Higher risk of transmission in schools	Highest risk of transmission in schools
CORE INDICATORS					
Number of new cases per 100,000 persons within the last 14 days*	<5	5 to <20	20 to <50	50 to ≤ 200	>200
Percentage of RT-PCR tests that are positive during the last 14 days**	<3%	3% to <5%	5% to <8%	8% to ≤ 10%	>10%
Ability of the school to implement 5 key mitigation strategies: • Consistent and correct use of masks • Social distancing to the largest extent possible • Hand hygiene and respiratory etiquette • Cleaning and disinfection • Contact tracing in collaboration with local health department Schools should adopt the additional mitigation measures outlined below to the extent possible, practical and feasible.	Implemented **all 5** strategies correctly and consistently	Implemented **all 5** strategies correctly but inconsistently	Implemented **3-4** strategies correctly and consistently	Implemented **1-2** strategies correctly and consistently	Implemented **no** strategies

NSTA Daily Do Lesson #2 (Forthcoming) - Summary

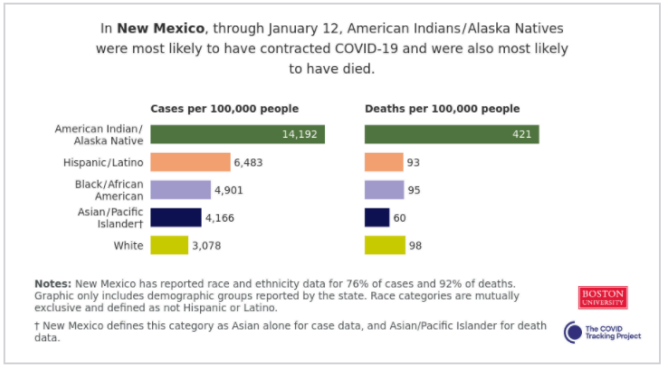
In the Lesson – Part 1

Can we identify differences in how COVID-19 is disproportionately impacting specific racial and ethnic groups in the U.S.?

	Cases in New Mexico	Deaths in New Mexico
Black or African American alone	1,669	32
Hispanic or Latino alone	55,628	783
Asian alone	1,103	16
American Indian or Alaska Native alone	22,971	691
White alone	19,991	597

In the Lesson – Part 2

Are there different ways we can examine our data to make comparisons among different racial and ethnic groups affected by COVID-19?



In the Lesson – Part 3

What are the possible causes of the disproportionate impact of COVID-19 we have identified?

- The Fullest Look Yet at the Racial Inequity of Coronavirus
- How COVID-19 is highlighting Racial Disparities in Americans' Health
- Many Latinos Couldn't Stay Home. Now Virus Cases Are Soaring in Their Communities.
- What Do Coronavirus Racial Disparities Look Like State By State?

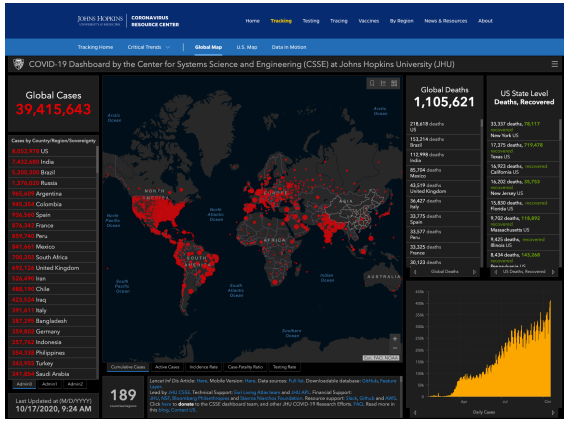
In the Lesson – Part 4

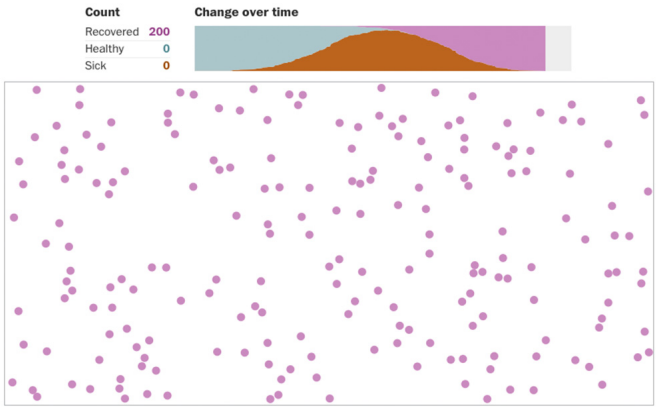
What justice-centered solutions can we propose to solve the problem of the disproportionate impact of COVID-19?

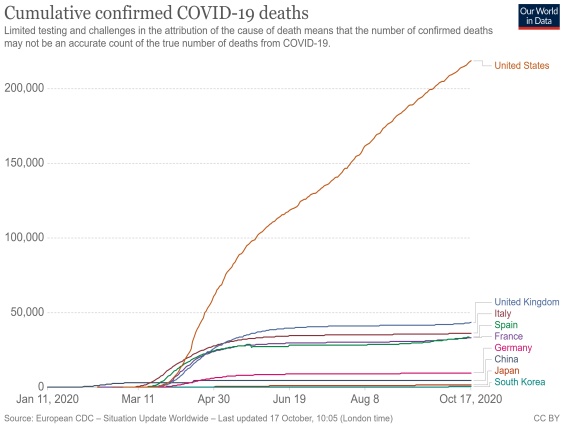
Write about one solution, and describe how it addresses any of the causes that you identified earlier in Part 3.

Summary

Use Multiple STEM Subjects to Make Sense of Complex Societal Phenomena and Problems

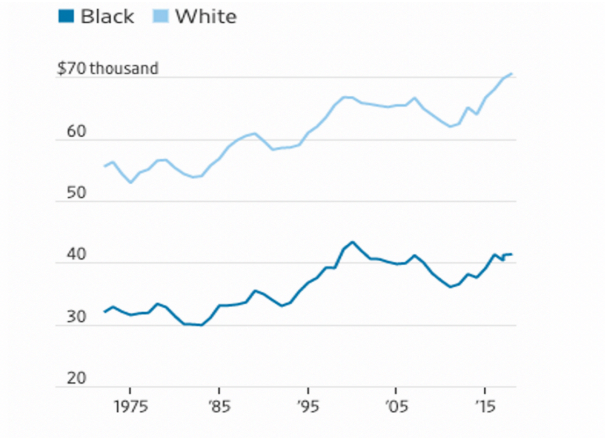


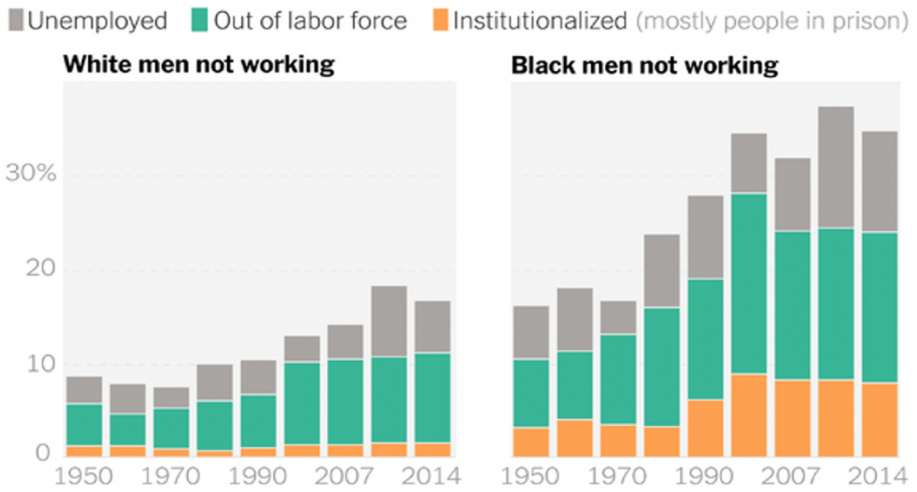




While Addressing Systemic Racism

Income Gap





New Roles for STEM Educators

Capitalize on the unparalleled opportunities as well as challenges presented by COVID-19

Envision a new–better–normal for STEM education centered around social justice for all students

PRIORITIES

We aren't just going to rebuild what has worked in the past. This is our opportunity to build back better than ever.

COVID-19

ECONOMIC RECOVERY

RACIAL EQUITY

CLIMATE CHANGE

- **Environmental Justice:** Ensure that environmental justice is a key consideration in where, how, and with whom we build — creating good, union, middle-class jobs in communities left behind, righting wrongs in communities that bear the brunt of pollution, and lifting up the best ideas from across our great nation — rural, urban, and tribal.

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Q&A

Please type your questions on Chat

(10 min)

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SEMINAR SERIES IN STEM EDUCATION

Thank You

Okhee Lee, New York University
&
Todd Campbell, University of Connecticut