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# Making Mathematics Meaningful

**A Mixed-Methods Study of Undergraduate  
Students' Learning through Social Justice**

Hanyi Xu  
Syracuse University

**Project Lead:** Nicole Fonger, Syracuse University

**Research Collaborators:** Emanuel Boutros, Stephen Caviness, Waleed Raja, Qiong Wu



# Meaningful Math Research Group, Spring 2024

## Principal Investigator



Associate Professor  
Nicole L. Fonger  
[nfonger@syr.edu](mailto:nfonger@syr.edu)

## Undergraduate Research Assistants



Hanyi Xu      Emanuel Boutros      Qiong Wu

## Funding Support

The SOURCE

The Mathematics  
Department

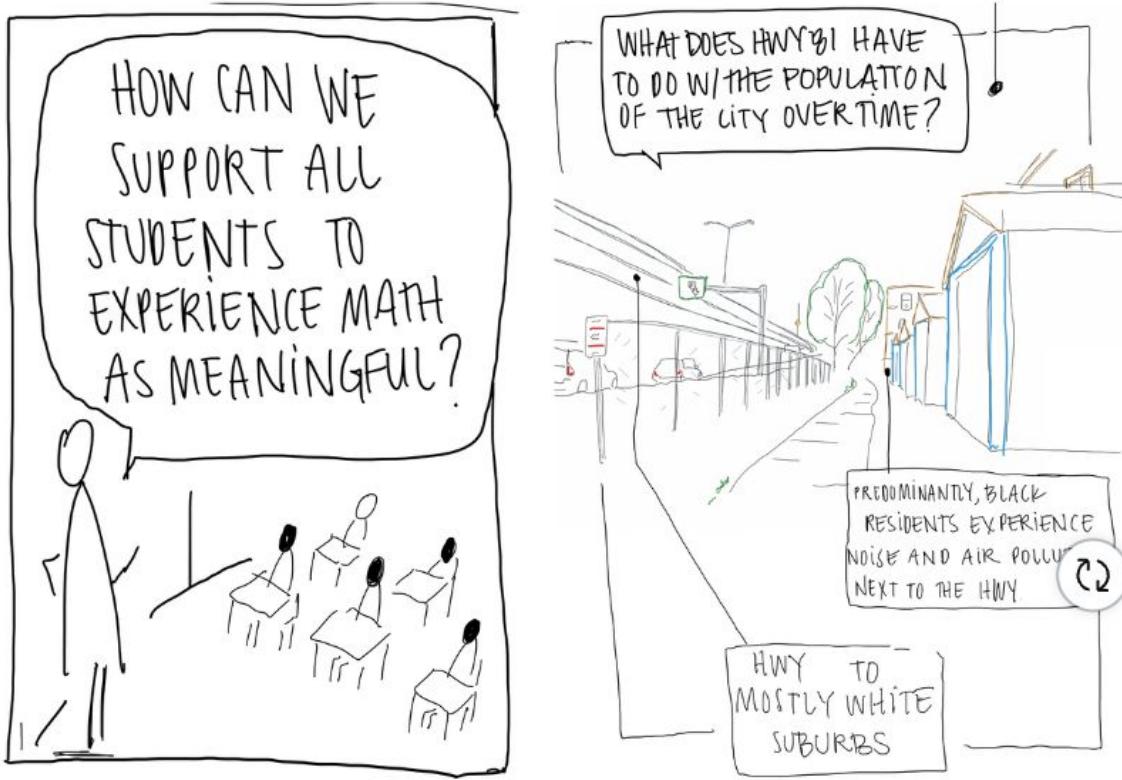
The Engaged  
Humanities Network

## Graduate Research Assistants



Stephen Caviness

Waleed Raja



(Zine illustrated by Dr. Nicole Fonger, 2022)

# Historically Responsive Literacy

(Muhammad, 2020, p48)

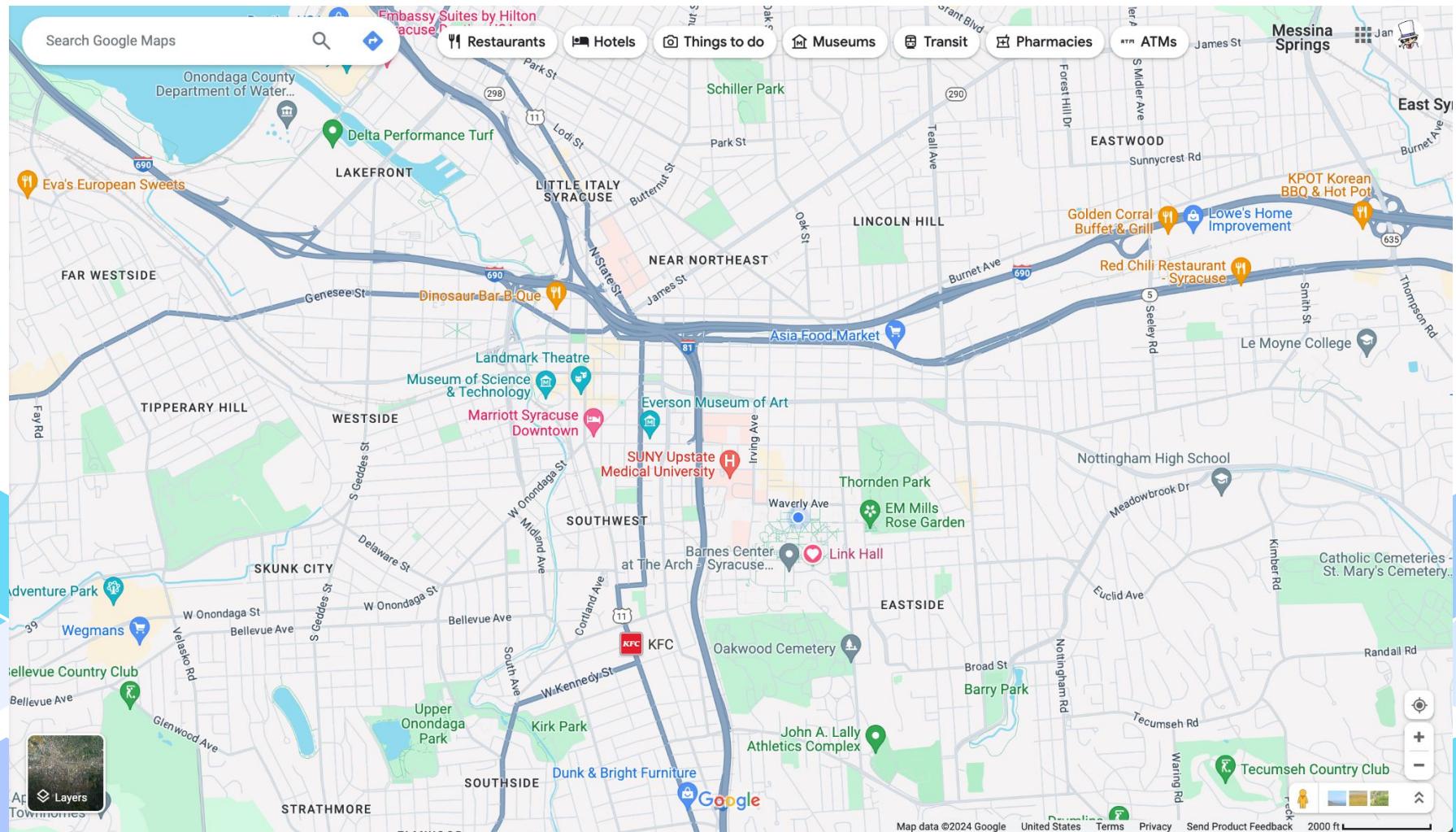
Identity

Skill

Intellect

Criticality

How does a *Historically Responsive Mathematics Education Lab* impact undergraduate students' **engagement, understanding of mathematical concepts, and awareness of social injustices?**



## A MAJORITY BLACK NEIGHBORHOOD IN SYRACUSE FACES A TRANSPORTATION NIGHTMARE

By [Lanessa Owens-Chaplin](#), Director, Racial Justice Center

MARCH 28, 2019 - 11:45AM

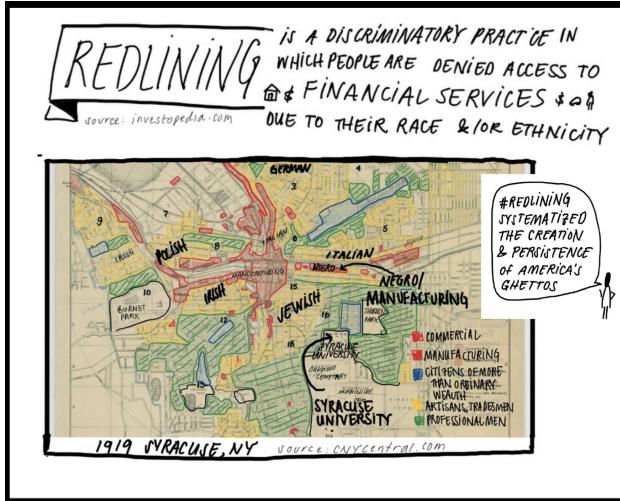


A huge infrastructure project set to break ground in Syracuse will significantly impact the lives of thousands of low-income people, in a primarily black neighborhood.

State officials are [weighing several options](#) to replace the crumpling [I-81 viaduct](#) that cuts through the center of Syracuse. But every option under consideration will significantly affect the lives of the people who live near the highway.

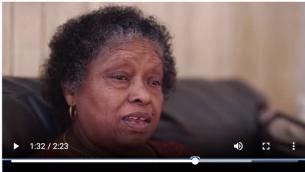
How residents are able to get around during the demolition of the viaduct should be at the forefront of any plans state officials come up with for replacing I-81. Helping community members deal with the impacts of the construction is vital to any plan. But New York's Department of Transportation has refused to consider mitigation efforts before a final decision on what will

**STAY INFORMED**



Student Screen Preview

I-81 in Syracuse was completed in 1969. The impact of the highway is still felt today.



NYCLU. "The I-81 Story." [www.youtube.com/watch?v=qvmWKS9lDko](https://www.youtube.com/watch?v=qvmWKS9lDko). Accessed 11 Mar. 2023.

Other than the decrease in out city's population and the destruction of the 15th Ward, what environmental impacts of I-81 are we still experiencing today?

Even today, I-81 is creating environmental inequity because...

Student Screen Preview

Images of residents from the 15th Ward during the 1950s. (Photos by Richard Breland)



What might the 15th ward neighborhood have felt like for Black Americans at the time?

Student Screen Preview

One of the major events that happened in Syracuse in the 1950s-1960s was the building of Highway 81.

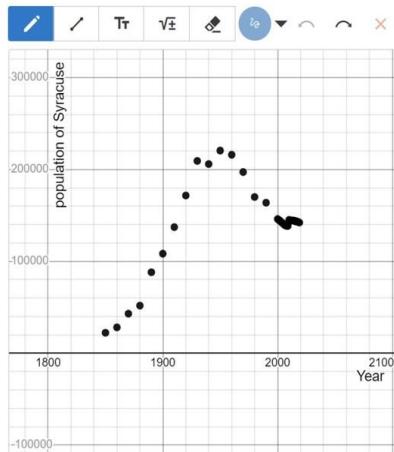
Explore this [guided visualization](#) to explore the 15th Ward in the past and in the present.



"the 1956 Federal Highway Act ... authorized money for the construction of the Interstate system. A strong highway network, city leaders argued, would make [Syracuse one of the largest cities in the country](#). Fewer roads would be able to

Label the coordinates for the years 1940, 1950, and 1960. Highlight those points on the table.

Year	Syracuse Population	Year	Syracuse Population
1850	22271	2005	140939
1860	28119	2006	139743
1870	43051	2007	138912
1880	51792	2008	138629
1890	88143	2009	138560
1900	108374	2010	145170
1910	137249	2011	144392
1920	171717	2012	144170
1930	209326	2013	144669
1940	205967	2014	144263
1950	220583	2015	144142
1960	216038	2016	143378
1970	197208	2017	143396
1980	170105	2018	142749
1990	163855	2019	142327
2000	146070		
2001	145056		
2002	144143		
2003	143169		
2004	142052		

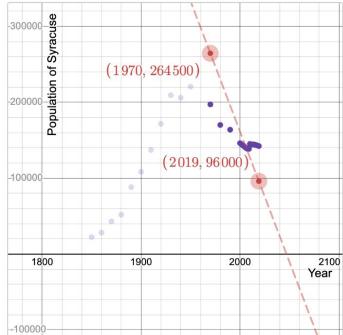


What was the change in population:

a. from 1940 to 1950?

Student Screen Preview

In the last part, we learned about Quadratic Regressions. We'll return to quadratics in Part 7. For now, let's take a  
into LINEAR REGRESSIONS.



Create a **line of best fit** for the population of Syracuse from 1970 to 2019 by adjusting the red sliders.

Using the formula for slope:

$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

Find the slope of your line of best fit.

$$m =$$



Using one of the red slider points, write the equation of your line of best fit.

If you get the equation right, your line of best fit will

Let's look at a smaller domain of the data -- from 2010 until 2019. What happens to our prediction?

Line of Best Fit Equation:

$$y = -272.436x + 692689$$

Let's learn to use this new equation to predict the population of Syracuse in 2021.

Substitute in for  $x$  to find  $y$ , the output.

$y$  is the predicted population of Syracuse in the year 2021.

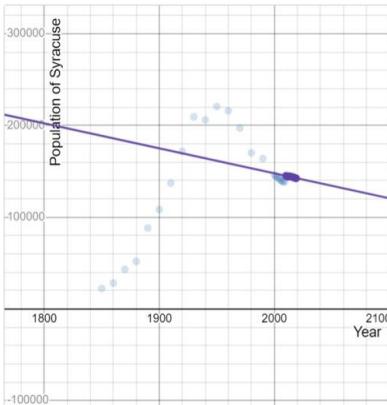
$$y = -272.436(x) + 692689$$



The actual population in Syracuse in 2021 was 141,491.

Our new prediction gives us percent error of about -0.4%. (Our prediction is only 0.4% low.)

What made this prediction so much more accurate?



Remember back in Part 4 when we saw that quadratic regressions model data that changes direction?

Here is a quadratic and exponential regression of Syracuse's population from 2015 to 2022. (2022 is the most recent available data.)

Which regression equation looks like a better fit for predicting the future population of Syracuse?

The regression equation that looks like a more accurate predictor is \_\_\_\_\_ because...



What do these regression equations predict about the future population of Syracuse?

For students using adaptive technologies such as screen readers, we have added keyboard shortcuts to enable them to fully participate in the lesson.

# Did you find the problem-solving lab to be meaningful? Explain

## ● Yes

"Yes, it was cool to do a lab and connect math to a real life problem in the city I now live in."

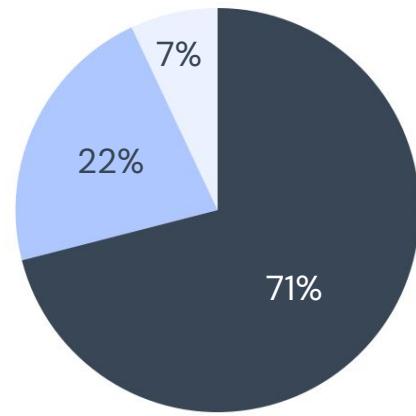
## ● No

"No, I'm not from Syracuse but I'm sure it affects the people here"

## ● Maybe

"It was, but it was just a lot of work. With other classes, this did make things more difficult."

● Yes   ● No   ● Maybe



# Did you find the problem-solving lab to be meaningful? Explain

## ● Relevant and Authentic

"It made me work through, and visually see the change in population of Syracuse after the highway was constructed."

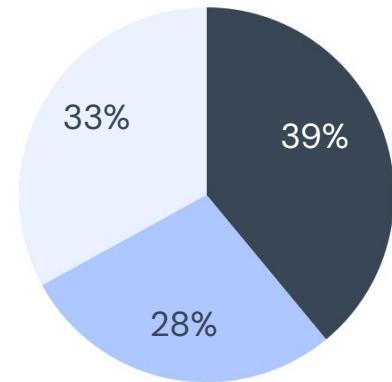
## ● Locality-Identity

"Yes because it informed me about what was happening in my community and for the future of Syracuse"

## ● Both

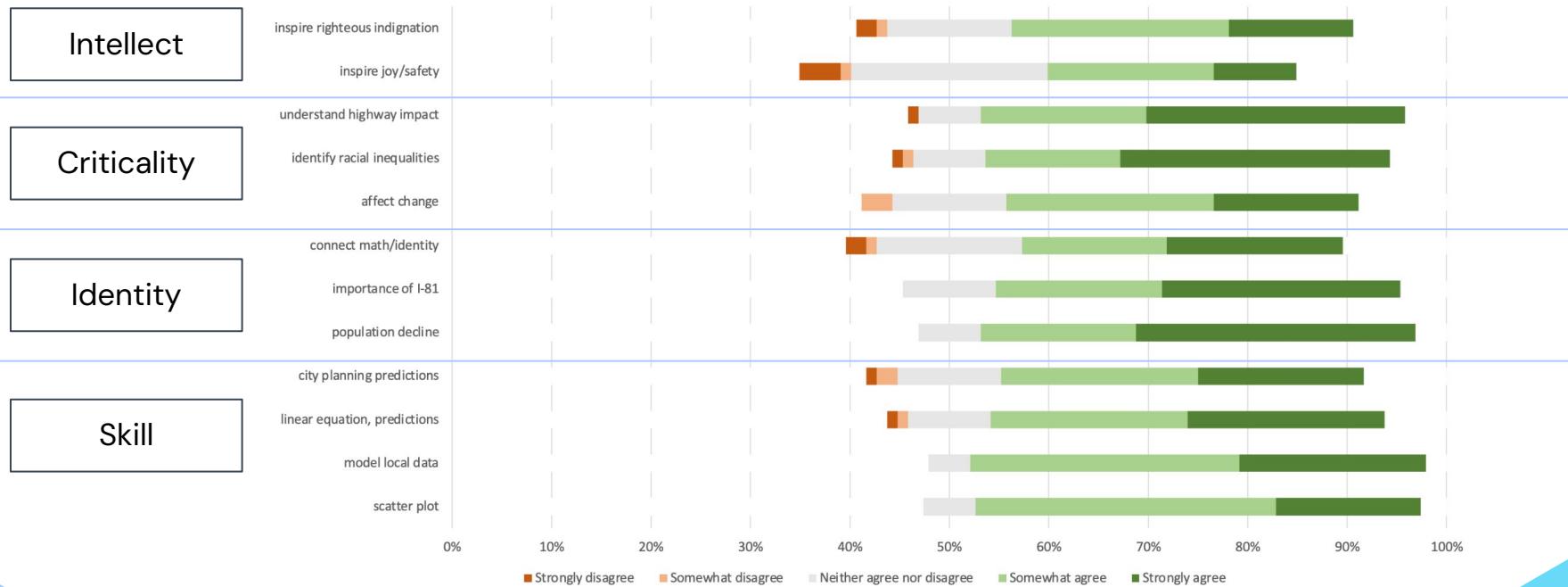
"It was meaningful because Syracuse is now my home and I need to be informed on what goes on around me."

- Relevant and Authentic
- Locality-Identity
- Both



# The Problem-Solving Lab supported me to...

Student Response Likert Scale Plot

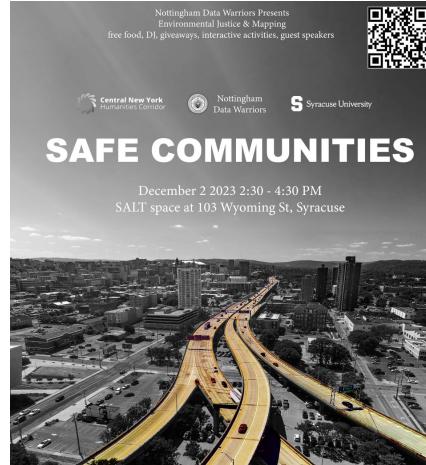


# Our Findings

Integrating real-world contexts and social justice themes into math instruction can make math more relevant and engaging for students.



Local High School Social Justice Mathematics Club



Social Justice Event Flyer

# Thanks!

Paper published at <https://surface.syr.edu/thecrown/vol1/iss1/16/>

hxu100@syr.edu

+1 (315) 640-9091

<https://hanyixu.com>



Meaningful Math Research Group, Syracuse University (Feb 2024)



Scan for full research paper